Sierra M6-1
SAS/SATA Protocol Analyzer

User Manual

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LeCroy Protocol Solutions Group
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Chapter 1

Introduction

This manual describes installation and operation of the LeCroy Sierra M6-1™ Protocol Analyzer and includes examples of typical applications.

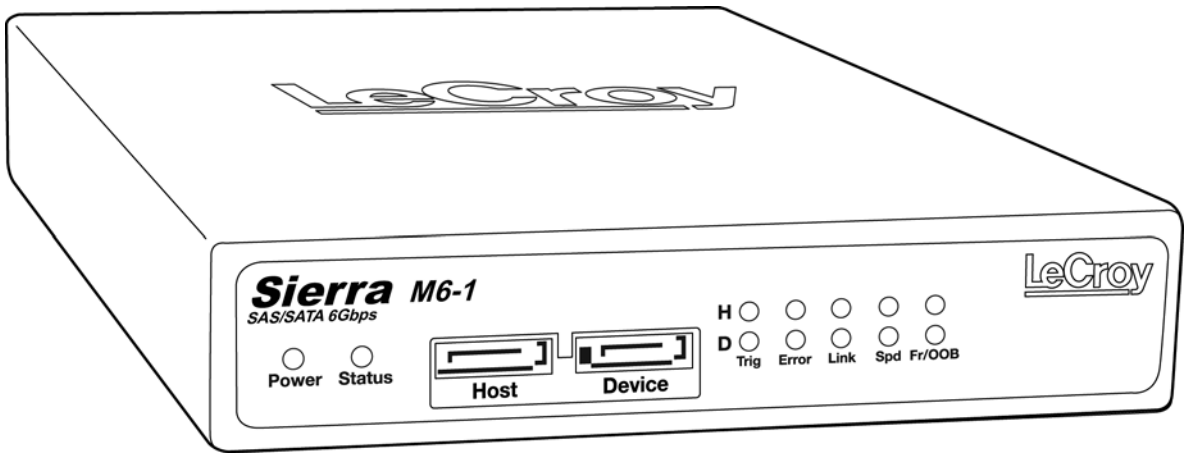


Figure 1.1: LeCroy Sierra M6-1 Protocol Analyzer

Analyzer Overview

The Sierra M6-1 SAS/SATA Protocol Analyzer is a portable single-port system that can function as a protocol analyzer or as an error injector. The SAS analyzer software performs serial bus analysis for Serial Attached SCSI (SAS) data transfers, as well as Serial ATA (SATA) data transfers through STP data transfers. The SATA analyzer software performs serial bus analysis for Serial ATA (SATA) data transfers.

The Analyzer can operate at 1.5, 3, or 6 Gb/s data rates and has 2 GB or 4 GB of recording memory.

The Analyzer supports capture, triggering, and filtering of Serial Attached SCSI packets or Serial ATA packets. The Analyzer provides for bi-directional trigger and capture of commands, primitives, patterns and all bus conditions. The analyzer allows you to select frames to include and exclude for capture. Capturing can be triggered based on a specific event or manually.

The Analyzer has a USB port and a GbE (Gigabit Ethernet) port to connect to a PC, which serves as the host for analysis or error injection software. The versatile GbE port can be used for either local or remote network connectivity.

Sierra M6-1 Analyzers can be linked together in cascaded configurations to provide additional recording channel capacity, or used in tandem to combine simultaneous error injection and trace capture/analysis capabilities (requires two Sierra M6-1 units, one protocol analyzer model and one error injector model). Separate licences are required for the protocol analyzer and the error injector.

The Sierra M6-1 Analyzer provides a full range of views and statistical reports. Statistical reports provide event and error counters, as well as performance metrics, that give users a snapshot into capture.

The InFusion™ Error Injector and Traffic Modifier is an error injector and traffic modification tool that allows you to verify real-world fault handling. The Sierra M6-1 InFusion models perform as a stand-alone 1.5, 3 or 6 Gb/s version, allowing engineers to verify error recovery characteristics of their designs. An easy pop-up menu interface allows the creation of customized test scenarios in just minutes. You can program on-the-fly modifications to any field within any intercepted and changed to a different user frame, as the data moves across the link. Any primitive or data pattern can be intercepted and changed to a different user-specified pattern. Examples include support for changing DWORD values, disconnecting links, and forcing various error conditions, such as an intermittent CRC error or running disparity errors. This enables unprecedented corner case testing for SAS and SATA traffic, which is especially useful during final test and integration cycles.

The Sierra M6-1 Analyzer software has an intuitive GUI, combining easy setup with flexible data analysis displays. The application layer view logically assembles frames and primitives that are part of a specific SAS or SATA command. You can quickly view the completion status of any command, which is especially useful in addressing system-level debug challenges.

Features

- 6 Gb/s SAS/SATA protocol analysis or error injection
- Native PHY for fast lock time
- Easy mode triggering
- Cascade up to 8 ports
- Sync with LeCroy Sierra and STX family products
- CrossSync Control Panel
- Hardware filtering
- Automatic error detection
- Comprehensive decoding of SAS and SATA data traffic
- Logical and chronological traffic displays
- Statistical reporting
- Trace memory of 2 GB or 4 GB
- GbE & USB 2.0 host interfaces
- Capture, triggering, and filtering of Serial Attached SCSI packets or Serial ATA packets

- TX Vout on transmitters for test and characterization
- Automation API
- Error Injection Functionality (Jammer)

Receiving Your Analyzer

The analyzer package includes the following components:

- 1 Sierra M6-1 Analyzer identified in the packing list
- 1 USB A-B 2.0 cable, 1.8 meter
- 1 Ethernet cable, 10 feet
- 2 SATA cables, 0.5 meter
- 2 SATA cables, 0.15 meter
- 1 Sync cable, 10-pin, 6 inch
- 1 DC power pack and cord
- 1 Installation CD ROM with software and documentation
- 1 Sierra M6-1 Quick Start manual

Unpacking the Analyzer

Inspect the shipping container for any damage. Unpack the container and account for each of the system components listed on the accompanying packing list. Visually inspect each component for any damage. In the event of damage, notify the shipper and LeCroy Corporation. Retain all shipping materials for shipper's inspection.

Analyzer Features

Front Panel

The Analyzer has the following features on the front:

- Power Indicator LED (green)
- Status LED (blue)
- Host SATA Connector
- Device SATA Connector
- LED Indicators for Host and Device
  - **Trig** trigger (blue)
  - **Error** error (red)
  - **Link** link (orange)
  - **Spd** speed level (yellow)

Speed	Host	Device
1.5G	Off	Off
3.0G	On	Off
6.0G	On	On

- **Fr/OOB** OOB (Out of Bound) or Frames (traffic) (green)
  Before the link, illuminates during the OOB sequence.
  After the link, indicates traffic on the bus.

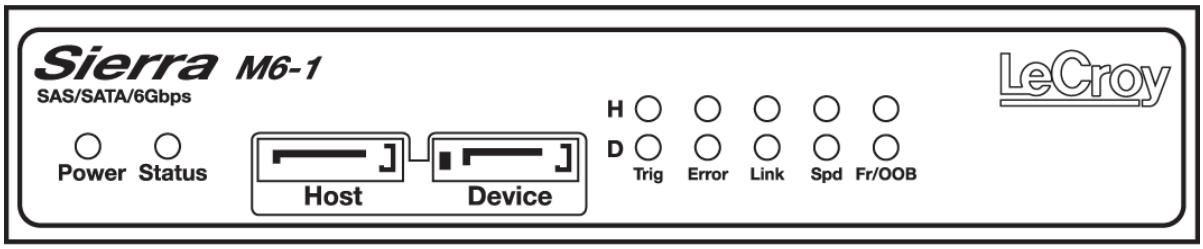


Figure 1.2: Front Panel

Rear Panel

From left to right, the Analyzer has the following on the back:

- USB Port for host connectivity
- External Trigger IN/OUT and Sync Expansion Port
- Gigabit Ethernet Port for network connectivity
- DC Power
- Power Switch (0/1)

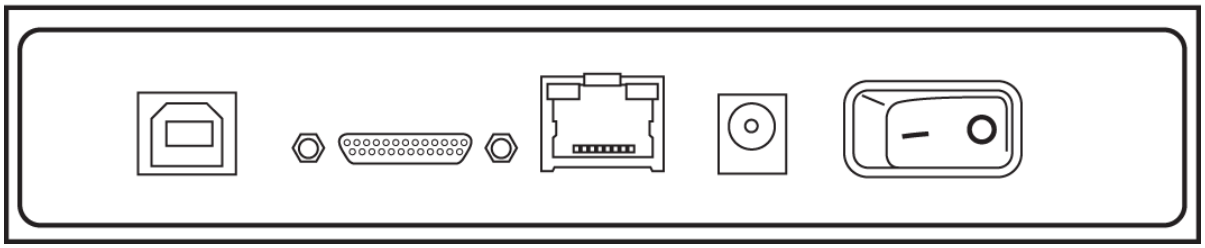


Figure 1.3: Rear Panel

WARNING: Do not open the enclosure. No operator serviceable parts are inside.

Temperature and Humidity

The hardware should operate flawlessly in the following temperatures range:

- Operating 0 °C to 55 °C (32 °F to 131 °F)
- Non-Operating -20 °C to 80 °C (-4 °F to 176 °F)

The hardware should operate in the following humidity range:

- 10% to 90% RH (non-condensing)

Installing Your Analyzer

Software Installation

The SAS and SATA software works on systems using the Windows® XP, Windows Vista, Windows 7, Windows Server 2003, and Windows Server 2008 operating systems. 64-bit Windows OS is recommended because it allows using more RAM memory. Other Operating Systems limit the RAM to 3GB.

Note on the Windows Vista Operating System: If the SAS or SATA software does not open, right-click the **SAS Protocol Suite** or **SATA Protocol Suite** icon and select **Properties** to display the Properties dialog. Select the **Compatibility** tab. Check to **Run this program in compatibility mode for Windows XP.**

Insert the Installation CD ROM into the CD/DVD drive on the host machine.

1. The installation automatically starts setup, unless Auto Run is off. In that case, select the CD ROM from “My Computer” and click **Setup**.
2. After the warning to close all other programs and before starting the installation, the Install component selection opens.
3. Select components for installation.
4. Click **Next** to complete the installation.

System restart

You must restart your computer before you can use your Analyzer software.

Error Message

If you get an error message during installation of the drivers for Window, consult your system administrator. Your system may allow only administrator-level users to copy such driver files.

Hardware Setup

Separate Systems

When using the analyzer, it is recommended to use a system to generate bus traffic and a second system to run the software, to avoid characterization of traffic generated by the analyzer.

Connecting in General

Note: You must install the software before connecting the analyzer to the host machine for the first time.

To set up the analyzer:

1. Plug the power adapter into the unit, and then plug the power adapter into a 100V–240V, 50Hz–60Hz, power outlet. Turn on the Power switch.

2. Connect the USB cable between the Sierra M6-1 USB port and a USB port on the Host PC. The host PC operating system detects the analyzer and driver files. (See “Connecting via Ethernet” on page 21 for Ethernet connectivity.)
3. Connect the analyzer to Host and Device as follows.

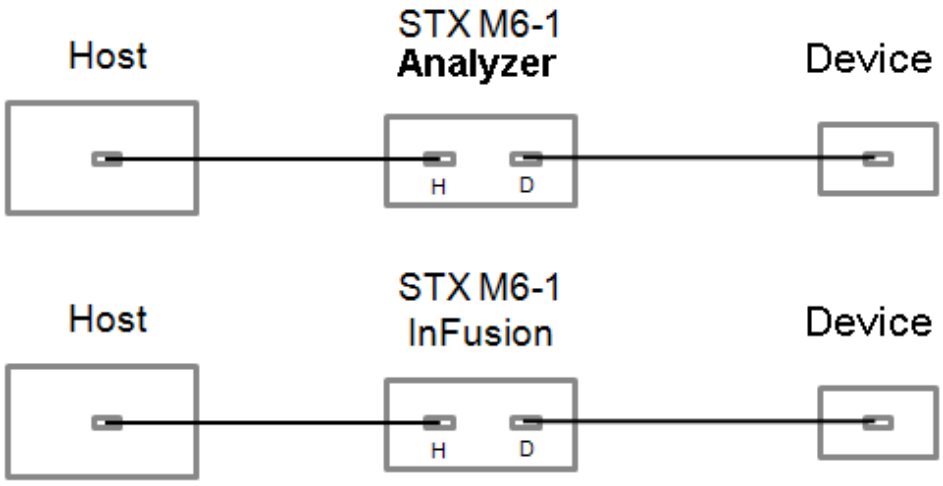


Figure 1.4: Hardware Setup

Cascading Sierra Analyzers

A Sierra M6-1 analyzer includes a built-in Sync port on the back panel (between the USB and Ethernet ports). See Figure 1.3.

To connect two Sierra M6-1 analyzers, plug the ends of a Micro-D Sync cable [AC031XXA-X] into the Sync ports.

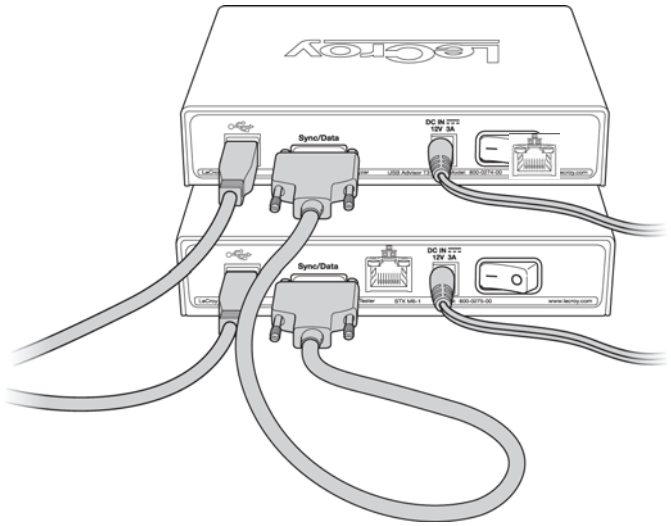


Figure 1.5: Cascading Two M6-1 Analyzers with a Micro-D Sync Cable

You must connect each of the analyzers to the Host PC using the USB port or Ethernet port.

Note: Before connecting, stop all recording. However, you do not have to turn power off.

For Sierra M6-1 analyzers connected by Sync cables, the SAS/SATA Protocol Suite application automatically synchronizes their recording timestamps, starts, and stops.

To connect three Sierra M6-1 analyzers, connect the Micro-D end of a Micro-D to DB-9 Sync cable [AC030XXA-X] to the Sync port of the first analyzer. Connect the male DB-9 end of the Micro-D to DB-9 cable to the female DB-9 end of a second Micro-D to DB-9 cable. Connect the Micro-D end of the second Micro-D to DB-9 Sync cable to the Sync port of the second analyzer. Connect the male DB-9 end of the second Micro-D to DB-9 cable to the female DB-9 end of a third Micro-D to DB-9 Sync cable. Connect the Micro-D end of the third Micro-D to DB-9 Sync cable to the Sync port of the third analyzer.

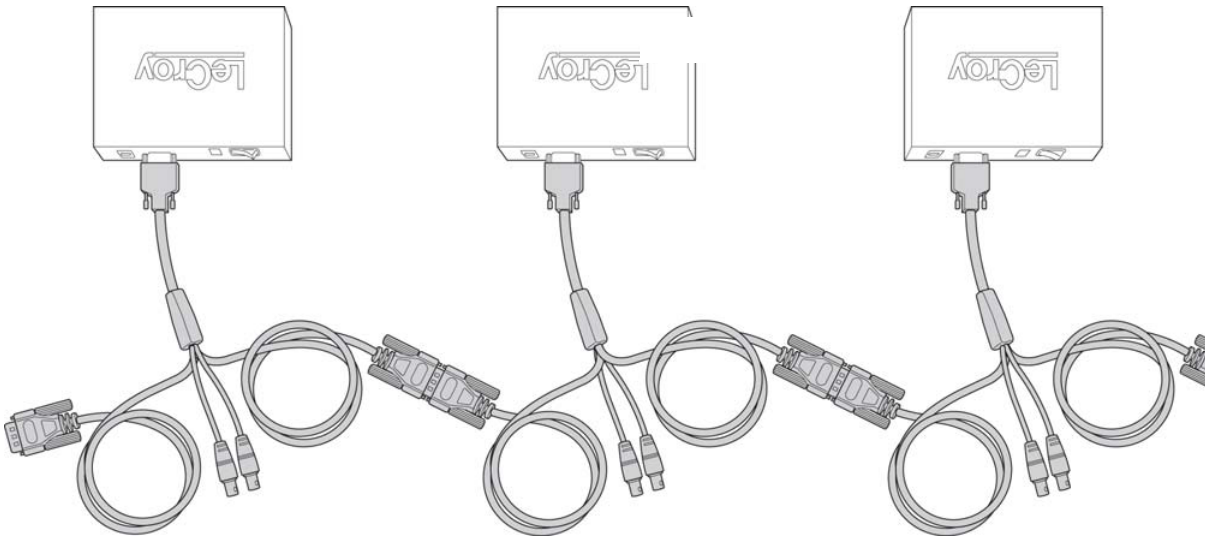


Figure 1.6: Example Cascading Three Analyzers with Micro-D to DB-9 Cables

To connect a Sierra M6-1 analyzer to a Sierra M6-2 or M6-4 analyzer with a CATC SYNC Expansion Card, connect the Micro-D end of a Micro-D to DB-9 Sync cable [AC030XXA-X] to the Sync port of the Sierra M6-1 analyzer. Connect the female DB-9 end of the Micro-D to DB-9 cable to the CATC SYNC OUT port of the Sierra M6-2 or M6-4 analyzer.

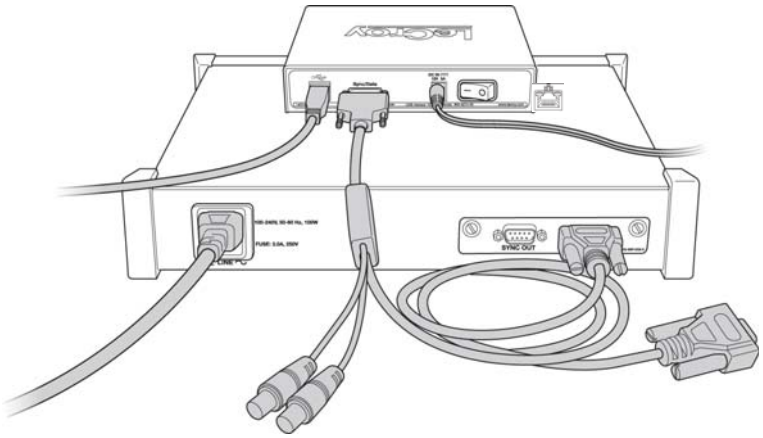


Figure 1.7: Cascading M6-1 and M6-2 or M6-4 Analyzers with a Micro-D to DB-9 Cable

Note: You cannot connect a Sierra M6-1 analyzer to a Sierra M6-2 or M6-4 analyzer with a STX SYNC Expansion Card.

For Sierra M6-1, M6-2, and M6-4 analyzers connected by Sync cables, the SAS/SATA Protocol Suite application automatically synchronizes their recording timestamps, starts, and stops.

For how to daisy-chain two or more Sierra M6-2 analyzers, see the *Sierra M6-2 User Manual*. For how to daisy-chain two or more Sierra M6-4 analyzers, see the *Sierra M6-4 User Manual*.

Note: You can use the Sync port to synchronize a Sierra M6-1 analyzer to analyzers with different protocols. You use a Micro-D Sync cable (AC031XXA-X) to connect to a LeCroy Advisor T3 analyzer. You use a Micro-D to DB-9 Sync cable (AC030XXA-X) to connect to other LeCroy analyzers. For more information, see the *CrossSync User Manual* and/or see “CrossSync Control Panel” on page 43.

Connecting via Ethernet

The Ethernet connection can have any of these configurations:

1. Analyzer connected to a network using a hub or switch, Gigabit Ethernet interface, or similar device.
2. Analyzer connected to the host computer (machine running the application software), using a hub or switch, Gigabit Ethernet interface, or similar device.

Connecting to a Network

When connected to a network, the analyzer can communicate with the DHCP server to obtain IP address configuration information in order to establish a connection.

Select Device

After starting the software, click on **Setup a**nd select **All Connected Devices** (see the following screen capture).

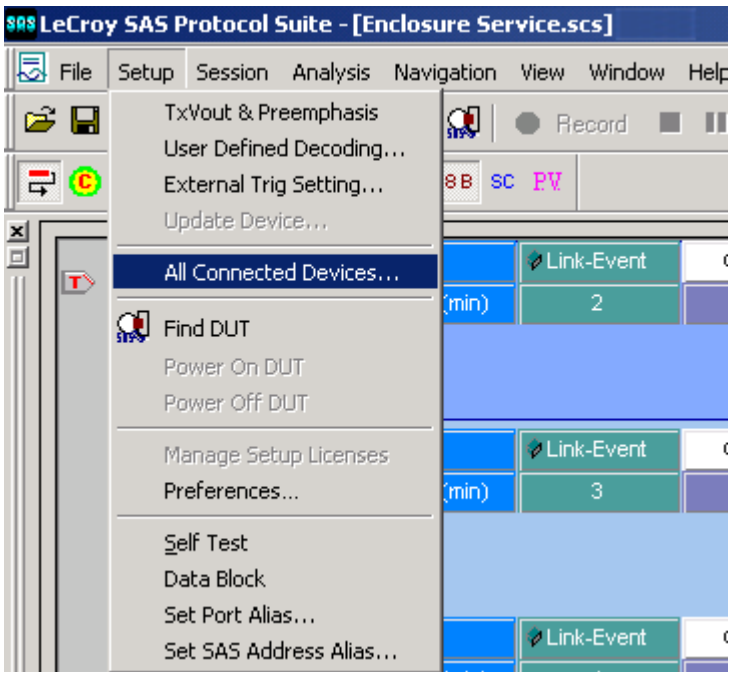


Figure 1.8: Connecting to All SAS Device(s)

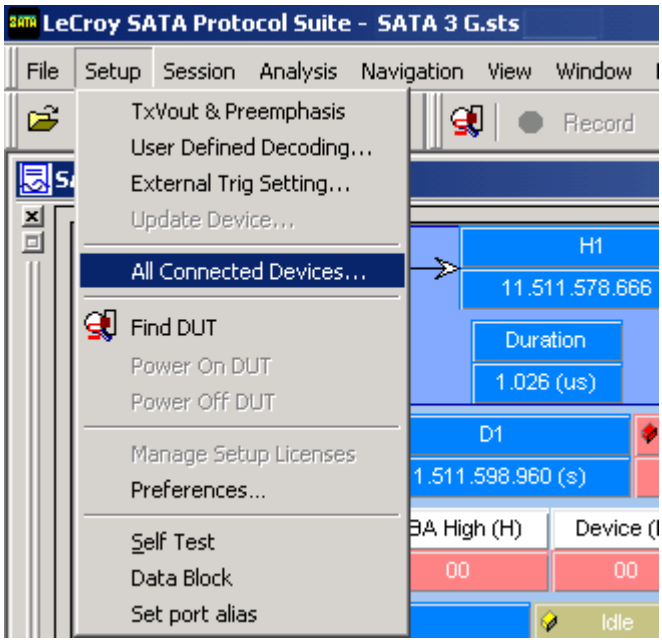


Figure 1.9: Connecting to All SATA Device(s)

The **Select Device** dialog allows connecting and disconnecting analyzers on the fly, without restarting the application.

The new Device List (introduced in version 4.10) mandates using updated firmware in order to detect the analyzer over Ethernet. Thus, the analyzer must be updated over USB before it can be used remotely over Ethernet. This is applicable for any update from version 4.00 or earlier to any version from 4.10 or later.

The following **Select Device** dialog displays. The colors in the 'Location' column mean the following:

- Red: Firmware and/or BusEngine components need to be updated to the latest version
- Light Blue: The device is ready to be connected.
- Yellow: The device is locked.
- Green: The software is connected and ready to run.

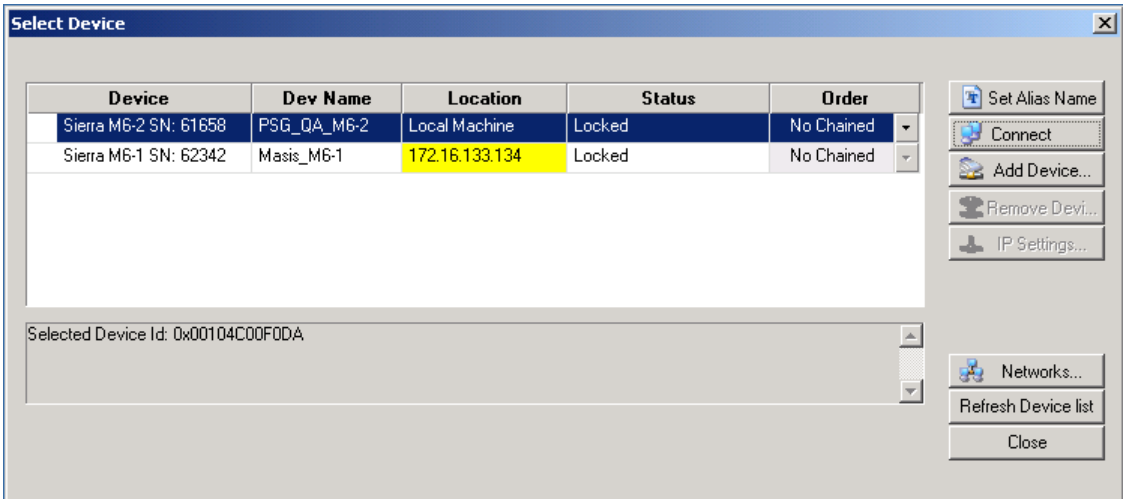


Figure 1.10: Select Device Dialog

Note: Click **Refresh Device List** to display all the devices on the network.

The Select Device dialog displays the following buttons:

Set Alias Name

Click **Set Alias Name** to display the Set device alias name dialog as shown below.

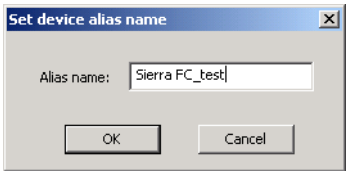


Figure 1.11: Set Device Alias Name Dialog

Disconnect

Click **Disconnect** to disconnect a device.

Add Device...

Click **Add Device** to add a device with a static IP address.

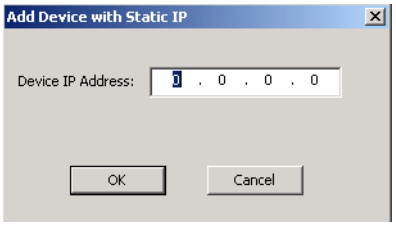


Figure 1.12: Add Device with Static IP Dialog

Remove Device

Click **Remove Device** to remove a previously added device.

IP Settings...

Click **IP Setting** to reset IP settings of a device. The following IP Setting dialog displays.

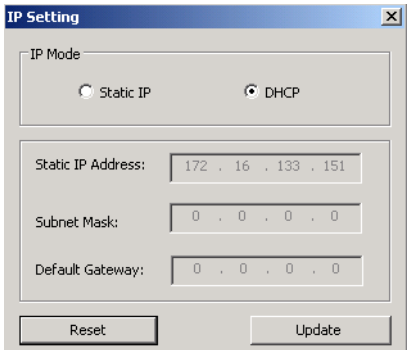


Figure 1.13: IP Setting Dialog

Networks...

Click **Networks** to select a network adapter. The following dialog displays.

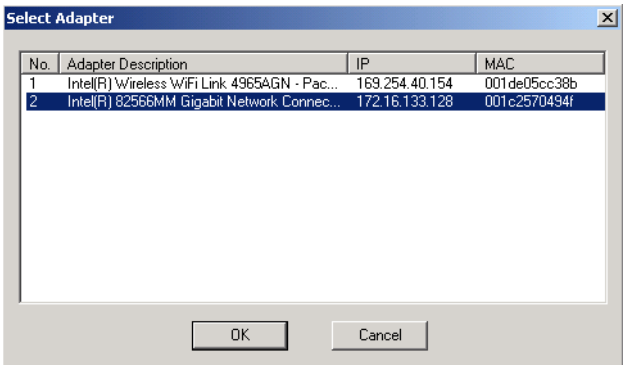


Figure 1.14: Select Adapter Dialog

Refresh Device List

Click **Refresh Device List** to refresh the device list.

To connect to a device, select a device which is Ready to Connect and click the **Connect** button on the right. The Connection Properties dialog is displayed (see the following screen capture).

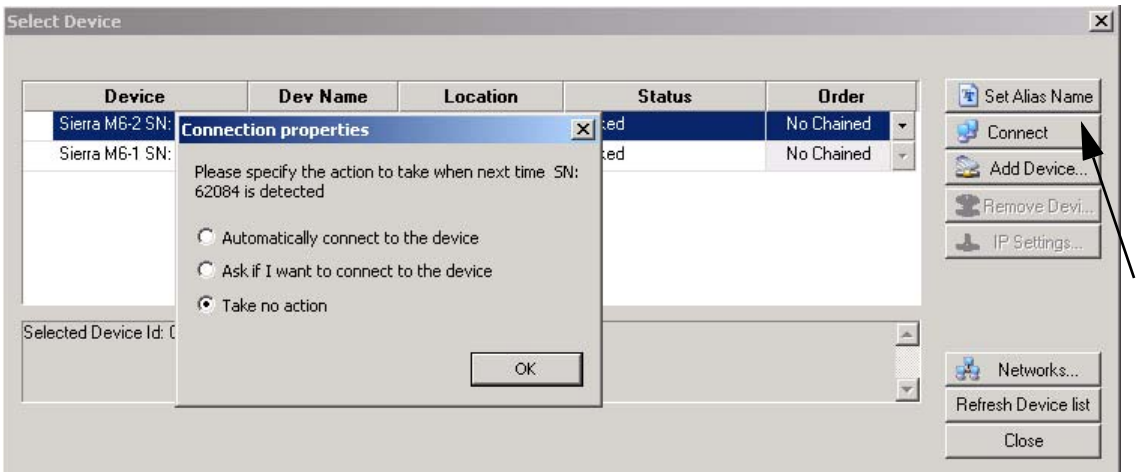


Figure 1.15: Connection Properties Dialog

Specify one of the actions from the following:

- Automatically connect to the device
- Ask if I want to connect to the device
- Take no action

If 'Automatically connect to the device' is selected, the next time the application opens the device will be automatically connected.

In the **Select Device** dialog chained or cascaded units are displayed in the **Device** column with a **[** (square bracket) icon. The sequence of the units is displayed in the **Order** column. See the following screen capture.

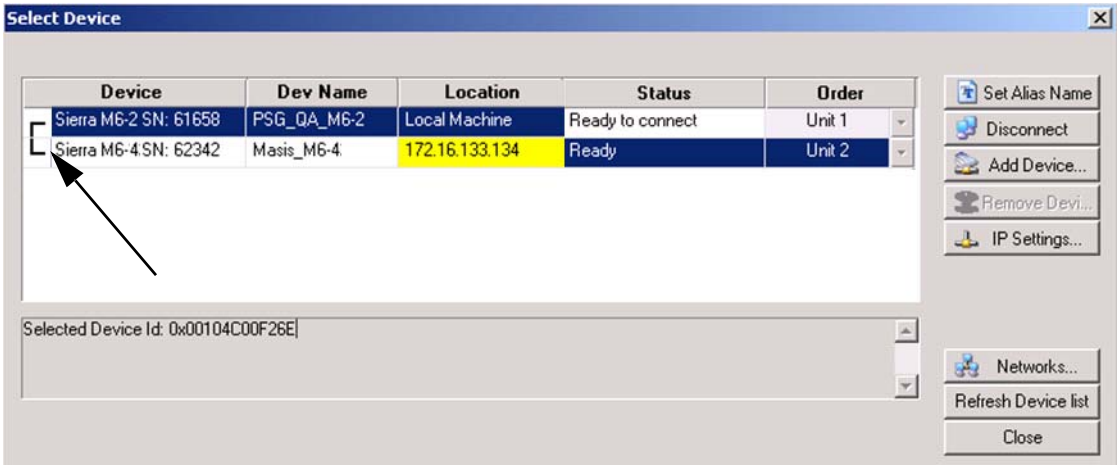


Figure 1.16: Select Device Dialog Displaying Unit 1 and Unit 2 Chained

Note: When using STX Sync cards, you need to manually specify the order of the chained units. To match your unit sequence to the address for each unit in the Select Device dialog, click the pull down tab under the Order heading (on the right side) and select unit numbers: 1 for Unit 1, 2 for Unit 2, and so on. This determines the order in which the cascaded ports appear in the trace. When using the CATC Sync cards the order is automatically detected.

IMPORTANT! Power up all units before starting the software.

Connecting over Different Subnets

If the Host PC (with the software) and Sierra M6-1 are on the same subnet, they will see each other's broadcasts, and the Sierra M6-1 application will automatically appear in the Select Device dialog, from which you can select a device (as described in the previous section).

If the Host PC and Sierra M6-1 do not reside on the same subnet, they will not see each other automatically. You must add the Sierra M6-1 IP address manually. To add the IP Address, use the **Add Device** button (see Figure 1.12 on page 24).

TCP and UDP Ports Must Be Open to Connect over Ethernet

WARNING: Check your firewall settings before making Ethernet connections. Incorrect firewall settings can prevent LeCroy applications from detecting analyzers on the network, though Ping works correctly. Consult your Firewall documentation to allow LeCroy applications access to the network.

The following TCP and UDP ports must be open to connect over the Ethernet:

TCP Port: 4000 to 4003

UDP Ports: 4015 to 4017

Launching Your Analyzer

To launch the software, double-click the **SAS** or **SATA** icon.

Operating in Simulation Mode

The SAS/SATA applications operate in Simulation Mode by default if the software detects no hardware.

The Analyzer software launches and displays the appropriate tool bar, but with the limitation that the Analyzer operates only on static, previously captured, bus data.

Limitations: Simulation Mode lets you try all of the available functions, but the system is not capturing any real data and is displaying only pre-captured results.

Using the Software

Depending on the software license(s) purchased with the unit, the Sierra M6-1 has SAS and SATA protocol capability or has SATA only. Use the SAS Protocol Suite or SATA Protocol Suite applications, respectively.

The LeCroy SAS Protocol Suite can be a:

- **Protocol Analyzer:** Captures data, triggers on events, and saves. **Easy Mode** allows standard Trigger and Data capture. **Advanced Mode** (requires license) allows you to program custom triggering in and out, capturing, state jumps, and timers (see “Protocol Analysis” on page 37).
- **Jammer:** The InFusion™ Error Injector and Traffic Modifier is an error injector and traffic modification tool that allows you to verify real-world fault handling (see “InFusion Overview” on page 233).

Note: The Advanced Mode option has to be purchased separately.

Getting Started with the Protocol Analyzer

To use the software for protocol analysis, first select **File > New > Protocol Analyzer** for a new project or **File > Open** an existing protocol analysis file: **.sac** for a SAS file or **.stc** for a SATA file (see “Protocol Analysis” on page 37). You can also open a **.scs** SAS Sample file or **.sts** SATA Sample file. Example files are in the Examples folder. You can also use **Project Setup > Last Protocol Analyzer.**

On the Capture tab, select to capture **Everything** or **Pattern**. For Pattern, select a Pattern. You can exclude patterns and frames. You can use different patterns for pre-trigger and post-trigger.

On the Trigger tab, select the trigger type. For Pattern, select the pattern.

On the Settings tab, select trigger position and memory use.

Change the Analyzer settings if necessary. Change the port Speed if necessary.

Use Advanced Mode only after you become familiar with the hardware and software and have special needs.

LeCroy SAS and SATA Protocol Suite Menu Options and Toolbars

This section lists all the SAS and SATA Protocol Suite application menu options and the toolbars.

File

The File menu options allows you to perform common tasks such as open, close, save, export, print, send files and exit the application (see Figure 1.17).

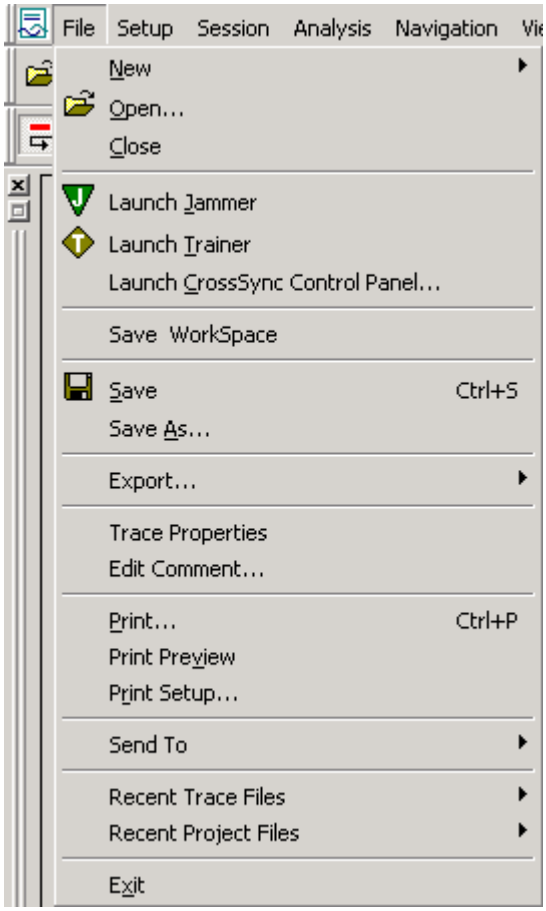


Figure 1.17: File Menu Option

Setup

For special work, you can use the Setup menu (see the following figure) to perform the following actions:

- Configure TxVout & Pre-emphasis (see “Tx Vout & Preemphasis” on page 202)
- User Defined Decoding (see “User-Defined Decoding” on page 215)
- External Trig Setting (see “External Trig Setting” on page 212)
- Update Device (see “Update Device” on page 213)
- All Connected Devices (see “Select Device” on page 21)
- Find and Power On/Off DUT (see “Find DUT” on page 226)
- Manage Setup Licences (see “Floating License” on page 211)
- Set Preferences (see “Software Settings” on page 203)
- Perform a Self Test (see “Self Test” on page 218)
- Create a Data Block (see “Creating a Data Block” on page 106)
- Set Port Alias (see “Set Port Alias” on page 200)
- Set SAS Address Alias (see “SAS Address Alias (SAS only)” on page 201)

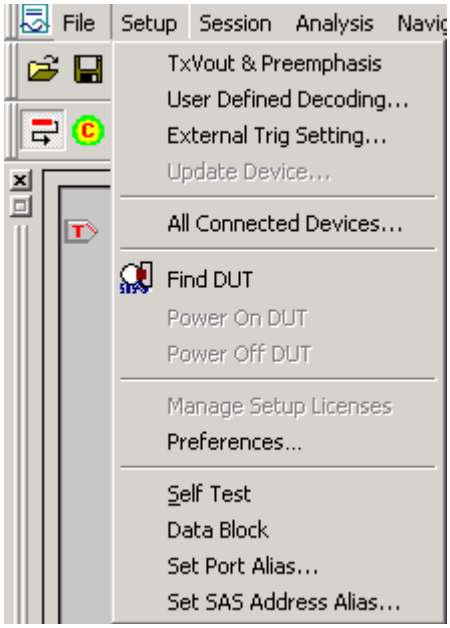


Figure 1.18: Setup Menu Option

Session

The Session menu has the following options:

- Start Capture/Record - Start capture or record a trace
- Pause Capture/Record - Aborts the capture without saving
- Stop Capture/Record - Stops the hardware
- Start Target Emulator - Starts the target emulator (SAS)
- Stop Target Emulator - Stops the target emulator (SAS)
- Start Device Emulator - Starts the device emulator (SATA)
- Stop Device Emulator - Stops the device emulator (SATA)

Analysis

The Analysis menu allows you to view captured data (see the following screen capture).

Menu items and toolbar options enabled and/or displayed are based on the type of window open. The following types of windows can be displayed:

- No active window
- Project file open
- Trace file open

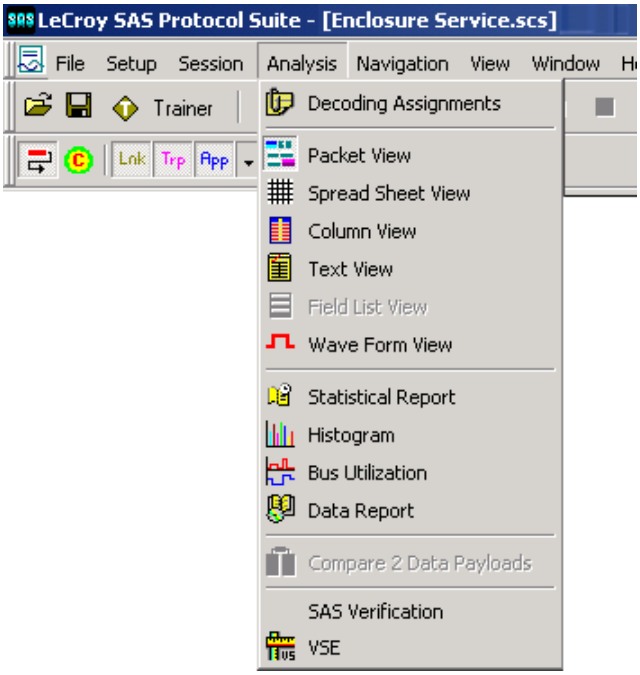


Figure 1.19: SAS Analysis Menu

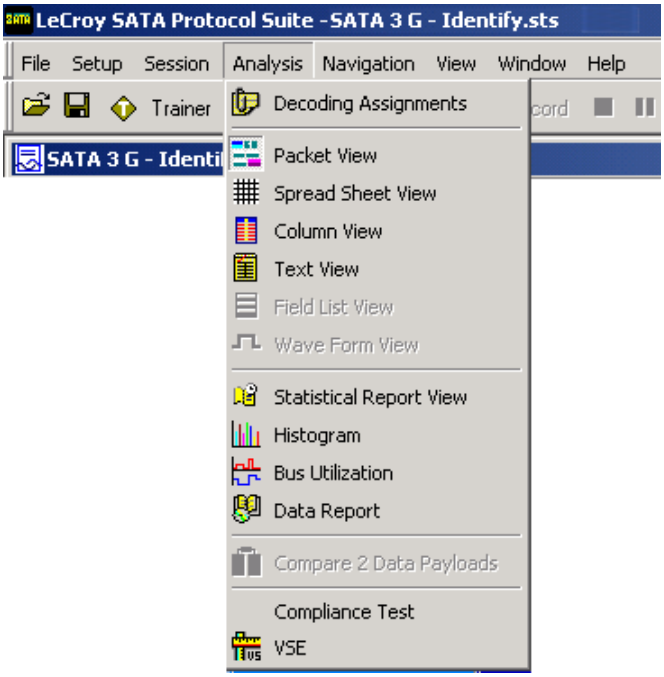


Figure 1.20: SATA Analysis Menu

Viewing Captured Data

After data capture, you can view the captured data in the Viewer by selecting **Analysis** (see "Analysis" on page 116). You can display the same data in:

- **Packet View**: Displays packets
- **Spreadsheet View**: Displays Packet View fields by time
- **Column View**: Shows DWORDs in columns by port
- **Text View**: Shows transaction frames, grouped in columns by port
- **Field List View:** Displays field information in a list format
- **Waveform Display**: Shows waveform display for all active ports, on which you can perform timing measurements
- **Statistical Report**: generate statistics for all transports, commands, primitives, bus conditions, addresses, lanes, and errors
- **Histogram View**: Shows frame-type transfers
- **Bus Utilization:** Displays the utilization of the bus
- **Data Reports**: Displays data payloads
- **Compare 2 Data Payloads**: Compares 2 data payloads
- **SAS Verification**: Verifies compliance with the SAS specification
- **VSE**: Perform custom post-process analysis of the open trace by running a verification script over the trace

Navigation

The Navigation menu has the following options to navigate through the application (see the following screen capture):

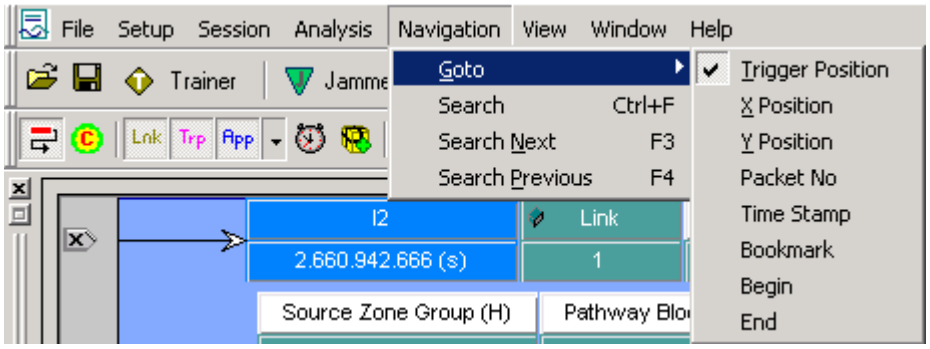


Figure 1.21: Navigation Menu Option

- Goto
  - Trigger Position
  - X Position
  - Y Position
  - Packet No
  - Time Stamp
  - Bookmark
  - Begin
  - End
- Search
- Search Next
- Search Previous

View

The View menu options allows the user to zoom in and out, enable/disable filtering and toolbars among other actions. It has the following options:

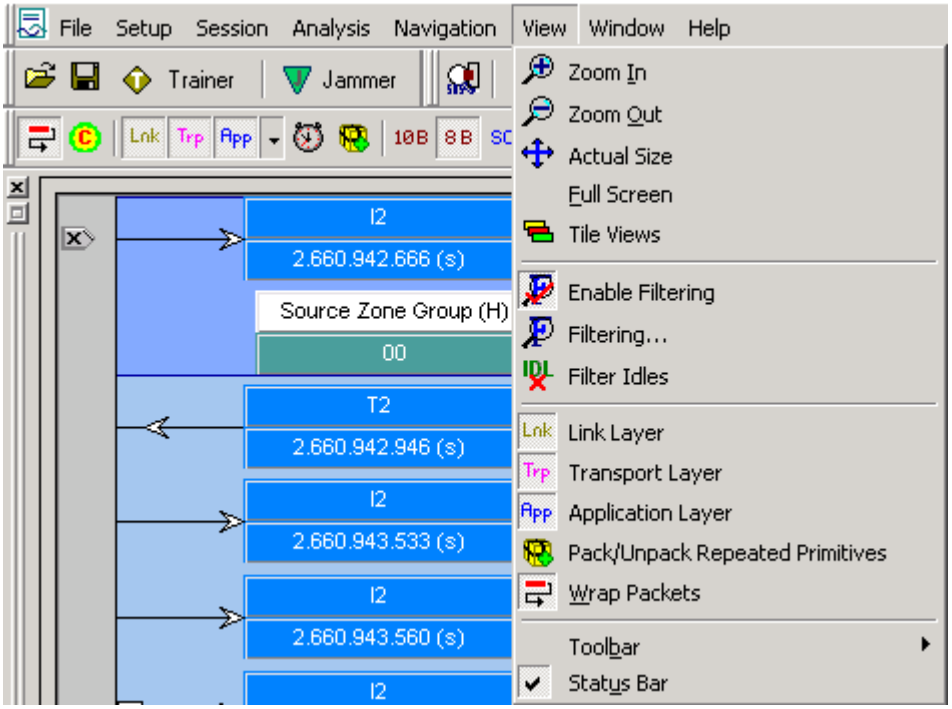


Figure 1.22: View Menu Option

- Zoom In (refer to “Navigation + View Toolbar” on page 162)
- Zoom Out (refer to “Navigation + View Toolbar” on page 162)
- Actual Size (refer to “Navigation + View Toolbar” on page 162)
- Full Screen (refer to “Navigation + View Toolbar” on page 162)
- Tile Views (refer to “Navigation + View Toolbar” on page 162)
- Enable Filtering (refer to “Filter Setup” on page 167)
- Filtering (refer to “Filter Setup” on page 167)
- Filter Idles (refer to “Filter Setup” on page 167)

- Link Layer-SAS only (refer to “Packet View Toolbar” on page 183)
- Transport Layer-SAS only (refer to “Packet View Toolbar” on page 183)
- Application Layer-SAS only (refer to “Packet View Toolbar” on page 183)
- Pack/Unpack Repeated Primitives-SAS only (refer to “Packet View Toolbar” on page 183)
- Physical Layer-SATA only (refer to “Packet View Toolbar” on page 183)
- FIS Layer-SATA only (refer to “Packet View Toolbar” on page 183)
- Command Layer-SATA only (refer to “Packet View Toolbar” on page 183)
- Wrap Packets (refer to (refer to “Packet View Toolbar” on page 183)
- Toolbar (allows you to customize the toolbar with the options given below)
  - Main
  - Record+Capture
  - Analysis
  - Navigation+View
  - Column View
  - Cursor position
  - Target Emulator
- Status Bar (refer to “Cursor Position Status Bar” on page 193)

Window

The Window menu has the following options:

- **Cascade:** Displays all open windows in an overlapping arrangement.
- **Tile Horizontal:** Displays all open windows in a above-below arrangement.
- **Tile Vertical:** Displays all open windows in a side-by-side arrangement.
- **Arrange Icons:** Arranges minimized windows at the bottom of the display.
- **Close All:** Closes all windows.

Help

For more information see “Help Menu” on page 216.

Toolbars

The toolbars enable you to perform several actions, some of which are listed below.

- Show or hide fields and ports, change port names, and change data format.
- Show the layers and channels using their toolbars.
- Decode using the Decode toolbar.
- Search and Filter.

There are four sets of toolbars:

- Main Toolbar - For details on the Main Toolbar refer to “SAS Main Toolbar” on page 40 and “SATA Main Toolbar” on page 41.
- Record Capture Toolbar - For additional information see “SAS Main Toolbar” on page 40 and “SATA Main Toolbar” on page 41.
- Target/Device Emulator Toolbar - For additional information see “SAS Main Toolbar” on page 40 and “SATA Main Toolbar” on page 41.
- Navigation + View Toolbar - For additional information see “Navigation + View Toolbar” on page 162.
- Show Analysis Toolbar - For additional information see “Show Analysis Toolbar” on page 116.
- Packets View Toolbar - For additional information see “Packet View Toolbar” on page 183.

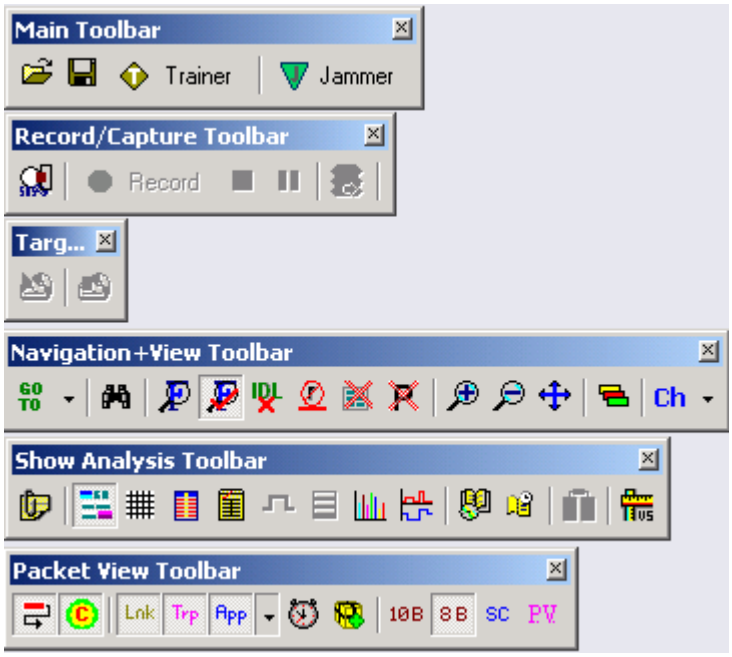


Figure 1.23: SAS/SATA Protocol Suite Toolbars

Port Status

You can display an overview of the active ports by clicking the buttons at the bottom right of the main window (See “Port Status” on page 191).

InFusion

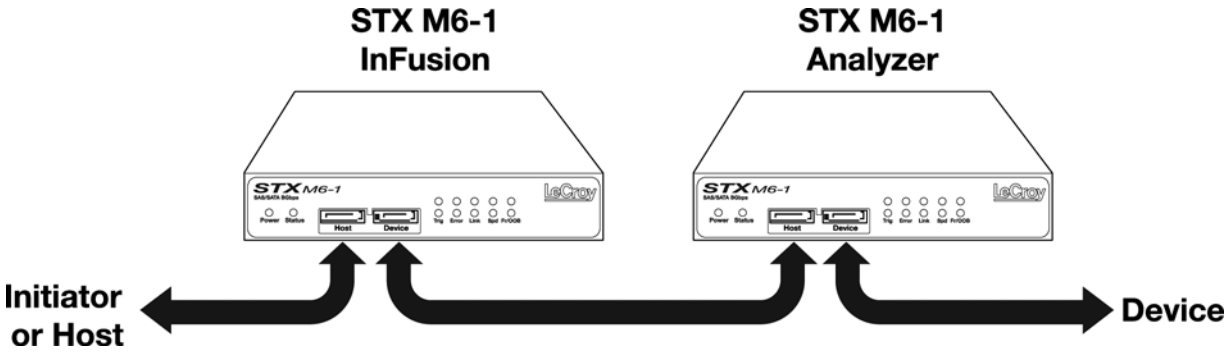
The LeCroy InFusion™ Error Injector and Traffic Modifier is an error injector and traffic modification tool that allows you to verify real-world fault handling for Serial Attached SCSI (SAS) and Serial ATA (SATA) systems. Click on the Jammer icon

to invoke the LeCroy SAS or SATA InFusion, (see "InFusion Overview" on page 233).

You can toggle between the InFusion and Analyzer panes by using the Alt+Tab keys, the Windows Task Bar or by pressing the respective toolbar button in each pane.

Analyzer and InFusion

Sierra M6-1 Analyzers can be used in tandem to combine simultaneous error injection and trace capture/analysis capabilities.



Chapter 2

Protocol Analysis

The system performs Protocol Analysis by defining and running an analysis project. An analysis project definition defines what to capture, what the analyzer triggers on, and the memory settings. You can save defined projects as project ***.sac** files for later use.

Easy Mode (Pre-Defined Setups)

After you install the Analyzer software (see "Software Installation" on page 17) and set up the Analyzer (see "Hardware Setup" on page 17), launch the Analyzer software (see "Launching Your Analyzer" on page 26) to display the default Protocol Analyzer in Easy Mode at the Capture tab.

This mode allows you to operate the analyzer with minimum setup. In this mode, you can perform only a Trigger and Data capture, or you can program the SAS Initiator Emulator or SATA Host Emulator to generate bus traffic for triggering and data capture.

Main Window

Use Easy Mode to get a comprehensive overview of your analyzer's capabilities:

SAS: On the Analyzer Menu Bar, click **File > New > Protocol Analyzer** to open a SAS Protocol Analyzer dialog.

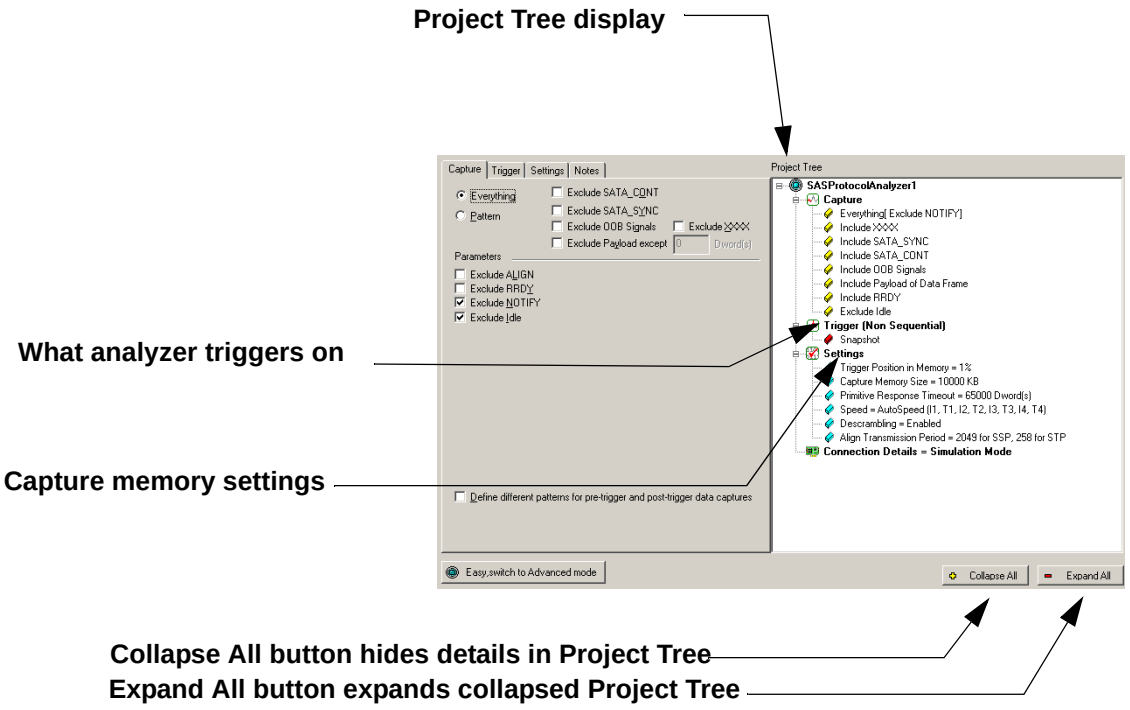


Figure 2.1: SAS: New Analysis Project Dialog

The New Project dialog opens with default settings to capture Everything on the bus and to Trigger On on Snapshot. (The analyzer captures everything immediately without triggering on anything in particular.)

SATA: On the Analyzer Menu Bar, click **File > New > Protocol Analyzer** to open a SATA Protocol Analyzer dialog.

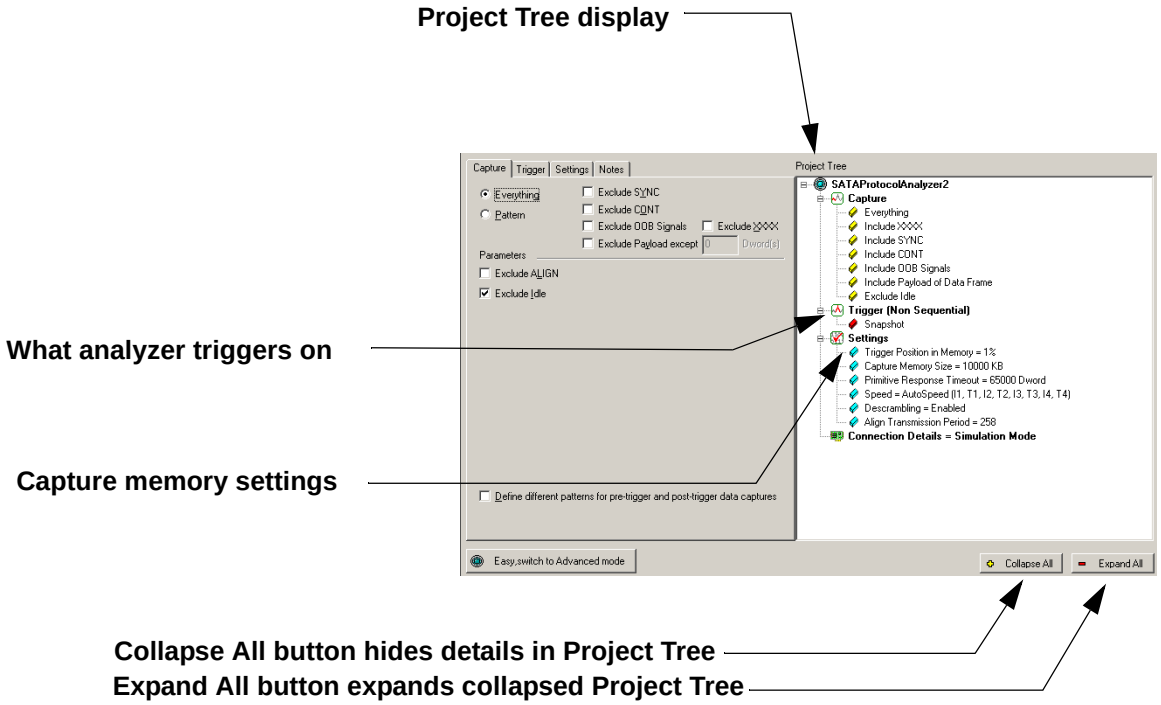


Figure 2.2: SATA: New Analysis Project Dialog

SAS vs. SATA: SATA Dialog does not show “Exclude RRDY” or “Exclude NOTIFY”. SATA Dialog replaces “Exclude SATA_CONT” with “Exclude CONT” and “Exclude SATA_SYNC” with “Exclude SYNC”.

Project Tree

The Project Tree on the right side of the main window displays a comprehensive tree structured overview of the project. The project tree shows what to capture, on what the analyzer triggers, and the capture memory settings.

Capture Tab Fields

The Capture tab has the following fields:

Exclude SATA_CONT (SAS) or Exclude CONT (SATA)

Check this to exclude SATA_CONT primitives from the data capture.

Exclude SATA_SYNC (SAS) or Exclude SYNC (SATA)

Check this to exclude SATA_SYNC primitives from the data capture.

Exclude OOB Signals

Check this to exclude OOB signals from the data capture.

Exclude XXXX

Check this to exclude XXXX patterns from the data capture.

Note: The validity of time stamps during Idles is traded off against good buffer memory utilization when using ‘Exclude XXXX’.

Exclude Payload except

Check this to exclude Payload of Data Frames from the data capture. You can except a number of DWORD(s).

Note: The Data Report does not reflect excluded Payload of Data Frames.

Note: When showing truncated data in the Data Payload View, the truncation points are marked with a separator placed between payloads. You can get more information about the data exclusion using the tooltip over the separator.

Exclude ALIGN

Check this to exclude ALIGN primitives from the data capture.

Exclude RRDY (SAS only)

Check this to exclude RRDY primitives from the data capture.

Exclude NOTIFY (SAS only)

Check this to exclude NOTIFY primitives from the data capture.

Exclude Idle

Check this to exclude Idles from the data capture.

Define different patterns for pre-trigger and post-trigger data captures

Replaces the Capture tab with a Pre-Trigger Capture tab and a Post-Trigger Capture tab.

SAS/SATA Software Menus and Toolbars

The SAS and SATA software has the following menus and toolbars.

SAS Main Toolbar

The following figure displays the SAS main toolbar.

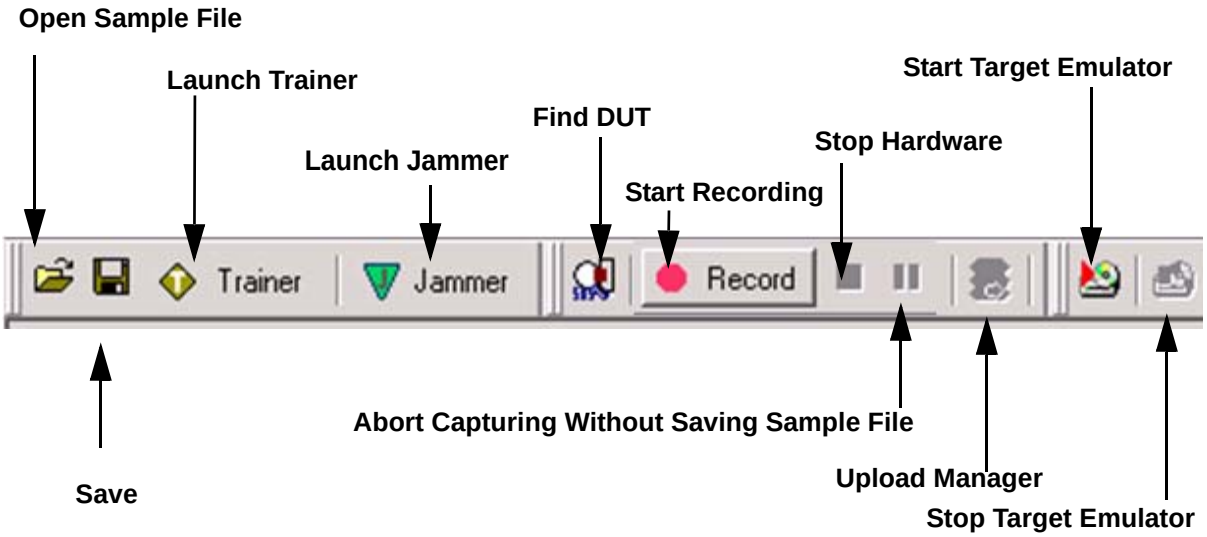


Figure 2.3: SAS: Software Menus and Toolbar

SATA Main Toolbar

The following figure displays the SATA main toolbar.

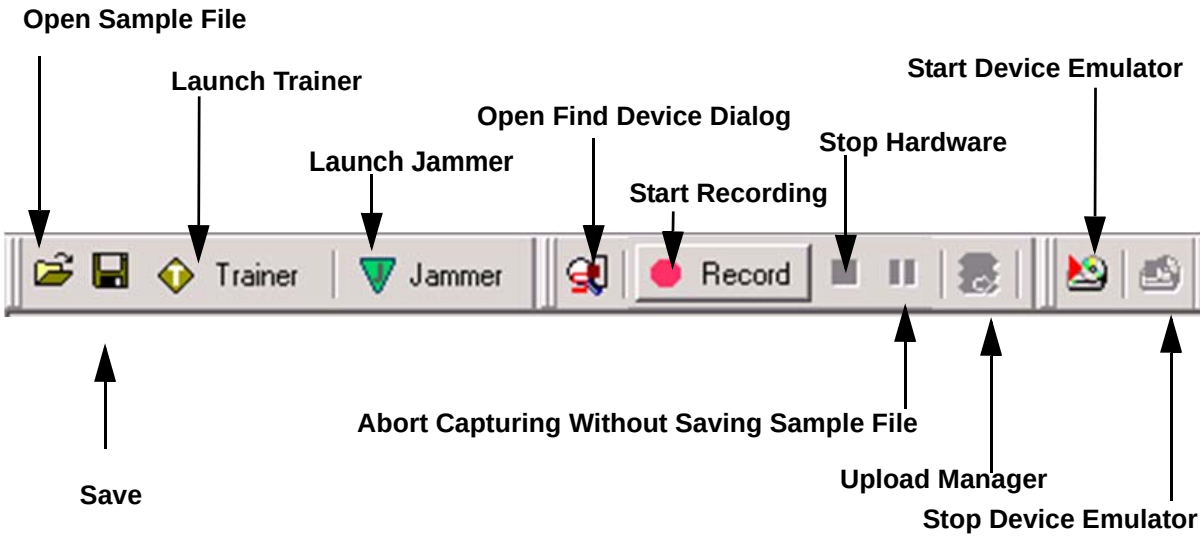


Figure 2.4: SATA: Software Menus and Toolbar

Run Hardware

To get an immediate overview of the bus traffic to and from your Analyzer:

1. Click the

Record button.
2. The analyzer begins filling the defined memory buffer with traffic on the bus. After the traffic fills the memory buffer, the traffic is uploaded to the viewer and the Packet View display opens. Packet View is the default display. However, you can view results in any of the different views by selecting **View** on the menu bar and choosing the desired View.

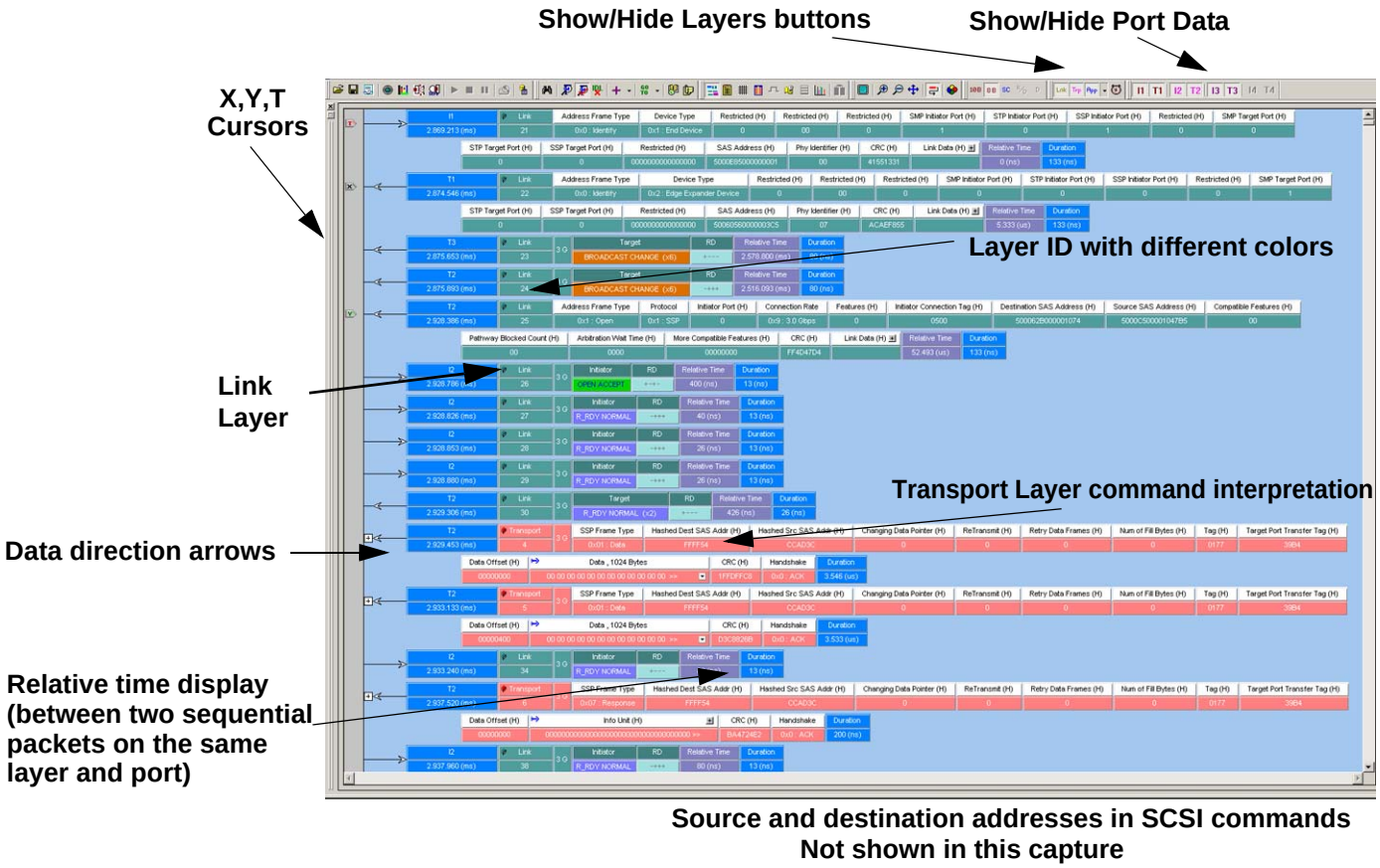

Show/Hide Layers buttons
Show/Hide Port Data
X,Y,T Cursors
Layer ID with different colors
Link Layer
Transport Layer command interpretation
Data direction arrows
Relative time display (between two sequential packets on the same layer and port)
Source and destination addresses in SCSI commands Not shown in this capture

Figure 2.5: SAS: Typical Packet View Results Display

Note: When using the Advanced Mode sequencer, the analyzer logs the state transitions in the trace, with the name the user gives to the state.

SAS: In case of an STP interface, the expander displays STP addresses provided to the SATA drive and the SAS software integrates the STP addresses in the ATA command.

The results display shows each transaction for every layer identified in a different color and the data direction identified with data direction arrows. Upstream traffic has an arrow from right to left: ⇐. Downstream traffic has an arrow left to right: ⇒.

You can hide any layer by clicking the corresponding **Show/Hide** button on the menu bar. The system retains all captured data, but the display has only some data layers for simpler viewing.

You can configure the viewer display for test and viewing preferences (see “Viewer Display” on page 113 for details about configuring the viewer display).

The Analysis Project dialog offers you a comprehensive set of choices to create a trigger and capture project satisfying some specific need. You can set the Analyzer to:

- Capture specific patterns (see "Patterns and Data Capture Setup" on page 53).
- Capture different patterns pre- and post-trigger.
- Exclude parameters from capture.
- Trigger on a pattern or sequence of patterns (see "Trigger Setup" on page 69).
- Configure trace capture memory (Settings tab).
- Select file to save trace capture in memory (Settings tab).
- Include a project note (Notes tab).

Launch Jammer

The Launch Jammer option invokes InFusion. For more information refer to “InFusion Overview” on page 233.

CrossSync Control Panel

The CrossSync Control Panel allows you to select analyzers for synchronization and manage the recording process.

CrossSync is LeCroy’s analyzer synchronization solution that enables time-aligned display of protocol traffic from multiple daisy-chained analyzers showing packet traffic from multiple high-speed serial busses. A lightweight software control panel allows users to select analyzers for synchronization and manage the recording process. Captured traffic is displayed using the latest analyzer software (in separate windows) with all the protocol specific search and reporting features.

Captured packets are displayed in separate windows that share a common time scale. Navigating the traffic in either direction will scroll to the same timestamp in a synchronized window. When using the CrossSync option, users can access the full complement of analysis capabilities available within the individual LeCroy software. Search, reporting, and decoding all operate normally.

This feature is available with the LeCroy SAS/SATA Protocol Suite application.

Launching the CrossSync Control Panel

To launch CrossSync from the SAS/SATA Protocol Suite software application, select the ‘**Launch CrossSync Control Panel**‘ entry in the ‘Project Setup’ menu (see the screens below). Or, you can launch CrossSync from the ‘**Start**’ menu.

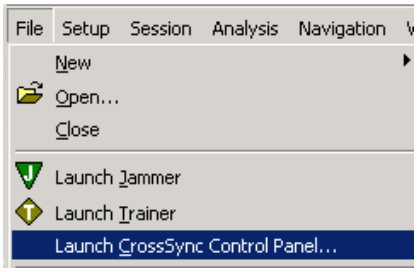


Figure 2.6: Launching CrossSync from the SAS Protocol Suite Application

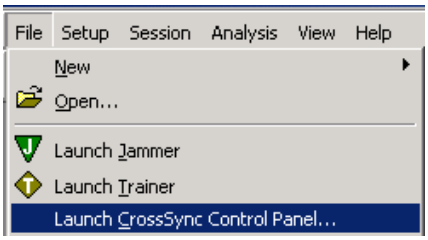


Figure 2.7: Launching CrossSync from the SATA Protocol Suite Application

Please refer to the ***CrossSync Control Panel User Manual*** for more information.

Save Workspace

The workspace **.wss** file sets viewing parameters.

After you open a trace and select views, you can save the viewing parameters in a workspace file. Select **File > Save Workspace** to open a Save As dialog. Save the current workspace as a **.wss** file.

To set a default workspace, select **Setup > Preferences > Software Settings** to open the Software Settings dialog. In the Default Workspace field, enter the path and name of a saved workspace **.wss** file.

After you open a trace, you can use a different workspace. Select **File > Open** to open to open another trace. Select a **.wss** file to open it.

Saving a Trace Capture

You can save a Trace Capture for review at a later time using the **Save As** dialog.

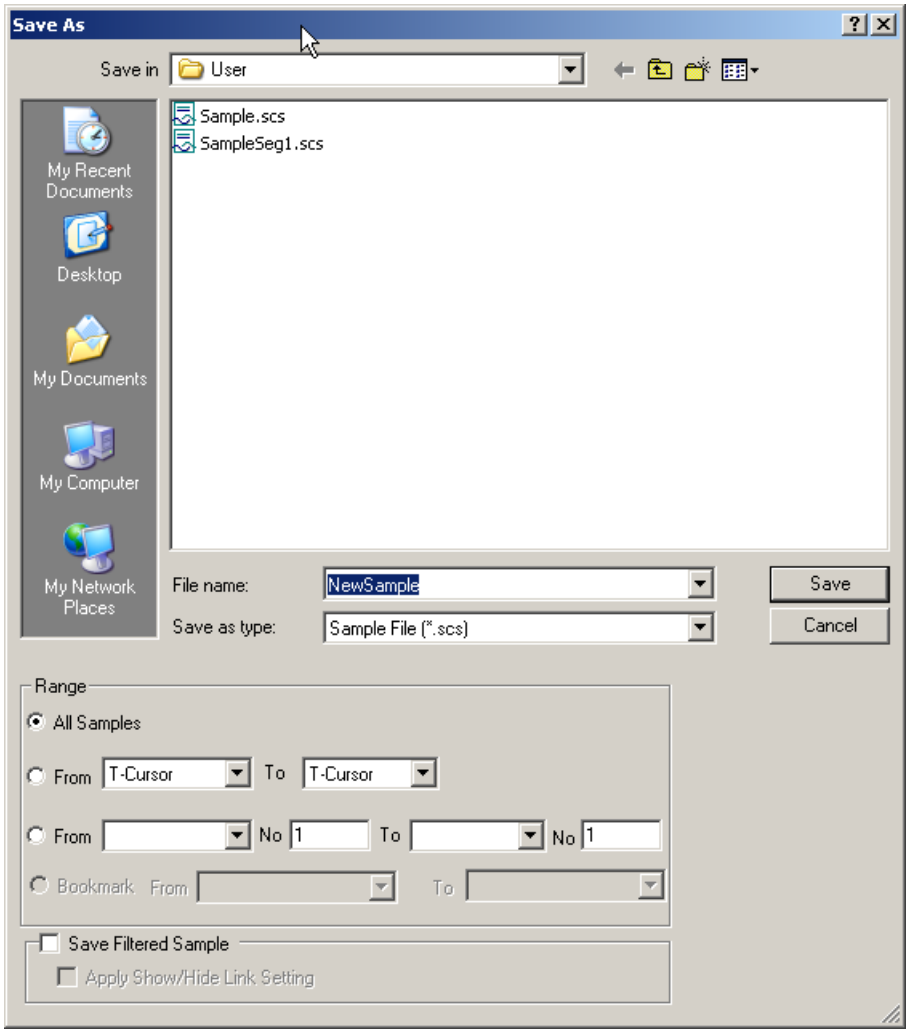


Figure 2.8: Save As Dialog

You can limit the range of the saved file. You can save:

- All Samples
- a range between selected cursors
- a range between selected Idle, link, commands
- range between bookmarks

Save Filtered Sample checkbox saves a trace file without filtered data. You can **Apply Show/Hide Link Setting.**

Note: If you deselect a port using the buttons on the toolbar, and then save the trace, on reopening the trace the deselected port will still display if you select the **Save Filtered Sample** checkbox and then check **Apply Show/Hide Link Setting** in save as dialog.

Exporting

From the File menu, you can Export to Text/Excel, Export to Initiator Emulator, Export to Trainer, Export Read-Write Command Report, or Export Paired SAS Address Report.

Export to Text/Excel

From the File menu, you can export to Text/Excel, using the **Export to Text/Excel.** The **Save as Text** dialog displays.

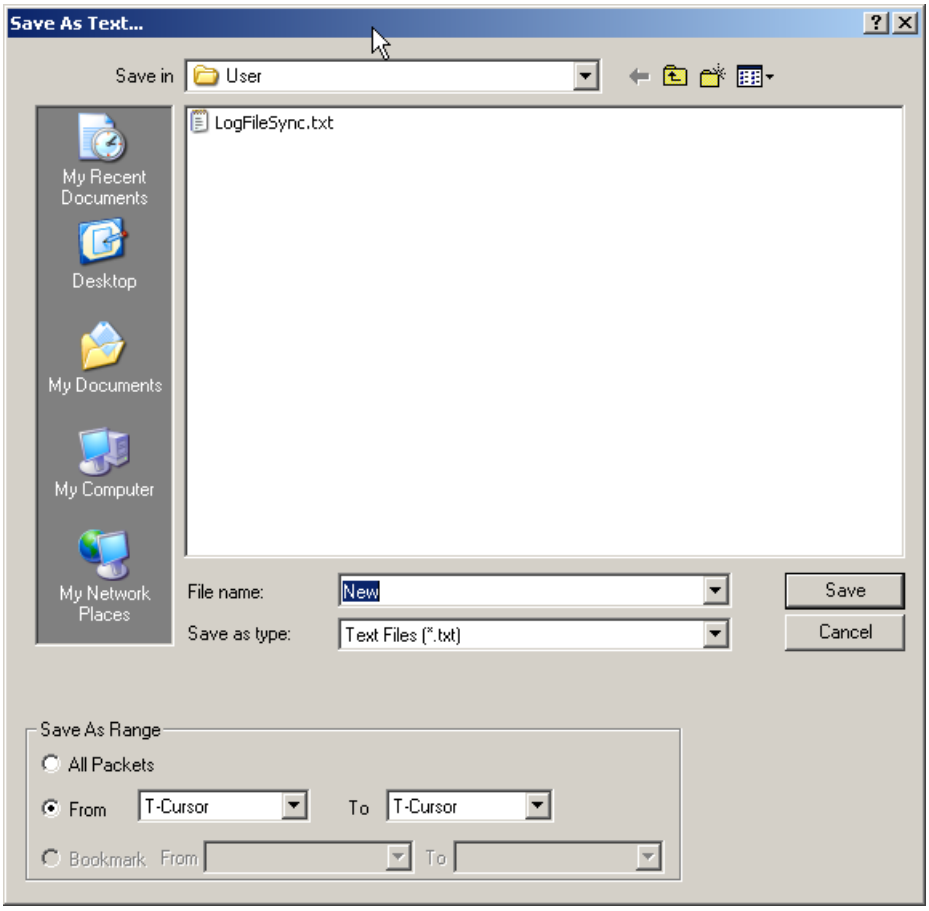


Figure 2.9: Save As Text Dialog

You can limit the range of the saved file. You can save:

- All Packets
- Range between selected cursors
- Range between bookmarks

Export to Initiator Emulator (SAS) or Host Emulator (SATA)

From the File menu, you can Export to Initiator Emulator (SAS) or Export to Host Emulator (SATA), using the Extract Sample File dialog (see following figures).

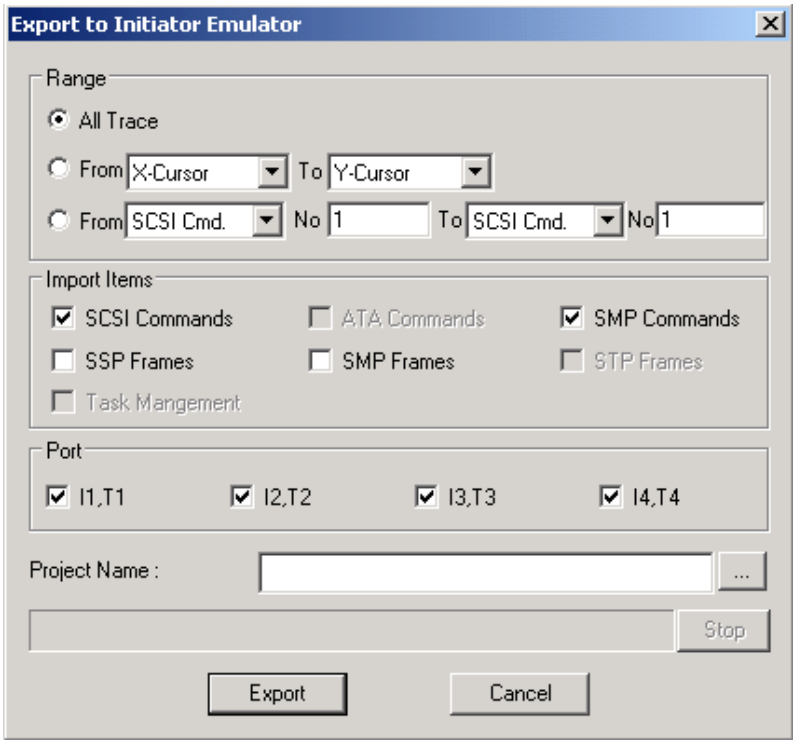


Figure 2.10: Export to Initiator Emulator (SAS) Dialog

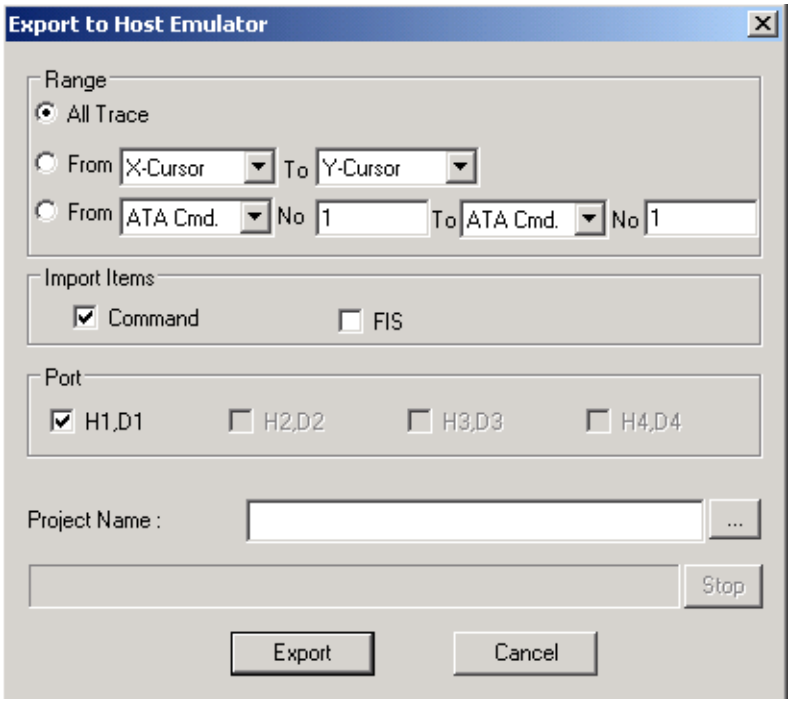


Figure 2.11: Export to Host Emulator (SATA) Dialog

You can limit the range of the saved file. You can save:

- All Trace
- Range between selected cursors
- Range between SCSI Commands or Transport

You can import **SCSI Commands, Task Management, ATA Commands, SSP Frames, SMP Frames, SMP Commands**, or **STP Frames**.

You can select the **Port**.

In the **Project Name**, enter a valid file.

Export Read/Write Command Report

From the File menu, you can Export Read/Write Command Report as an Excel file, using the Save As dialog.

Export Paired SAS Address Report

If Text View is activated, from the File menu you can save a Paired SAS Address Report as an Excel file, using the Export Paired SAS Address Report dialog (see following figure).

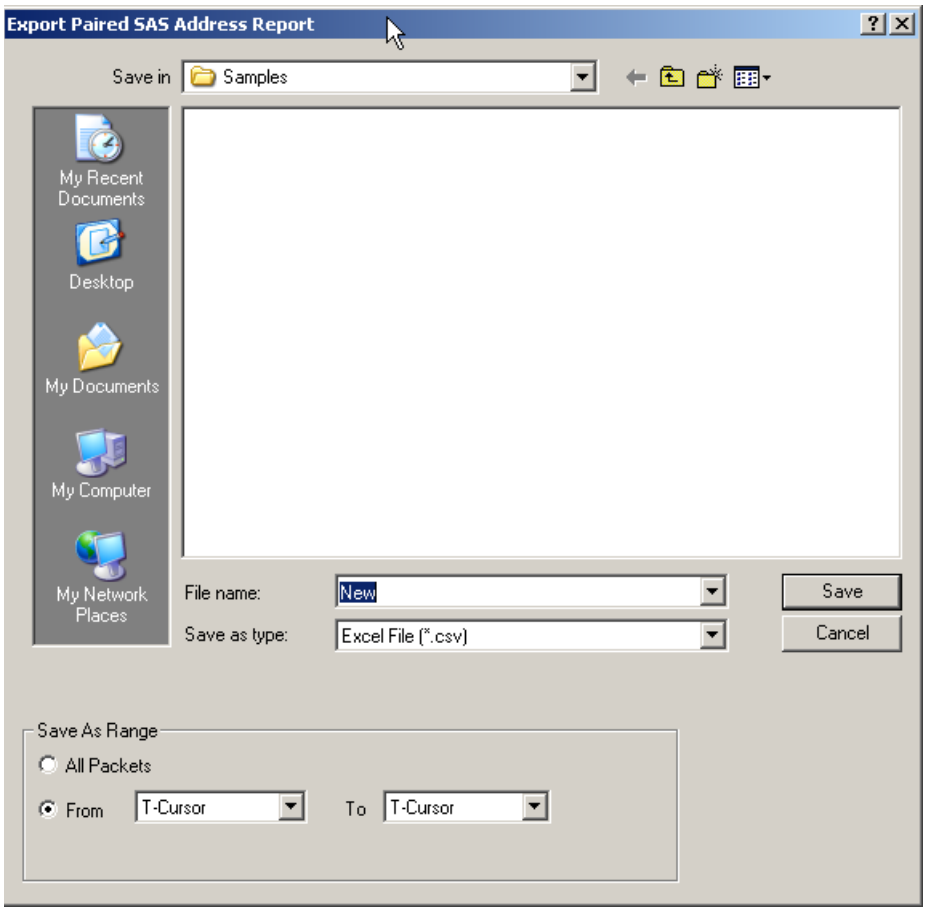


Figure 2.12: Export Paired SAS Address Report Dialog

You can limit the range of the saved file. You can save:

- All Packets
- Range between selected cursors

You can view expander traffic (particularly during discovery) in a spreadsheet format. You can use column headers with SAS Address Pairs. For example, instead of I1, T1, I2, T2, and so on, the columns are Source/Destination SAS Address pairs, such as S1:SEP or S2:EXP 0.

Projects

You can define a new project, starting with the default project definition, or modify the settings for the last project run.

New Default Project
To start a New project, select File > New on the main menu bar and choose Protocol Analyzer to open a new project with default settings that you can modify (see “Main Window” on page 37).

Last Project

Clicking the Green button opens the last project run, so you can modify it.

Project File Types

Projects have the following file types:

*.asl	Decoding script file (in the Examples folder “User Define Decoding Script” subfolder)
*.cfg	Display Configuration file (in the System folder “Config” subfolder)
*.dat	DataBlock file (in the System folder “DataBlock” subfolder)
*.sac	SAS Protocol Analyzer/Capture Project/Viewer file (in the Examples folder “EasyCaptr”, “AdvanceCaptr”, or “Exerciser” subfolders)
*.saf	Device Identifier file
*.scs	SAS Sample file (in the SAS Examples folder “Sample” subfolder)
*.sde	Device Emulator file (in the System folder “Compliance” subfolder)
*.sfl	Filter configuration file
*.spg	Single-role Pattern Generator file (in the Examples folder SAS “PatternGenerator\Single role (spg files)” subfolder and SATA “PatternGenerator\Single Role” subfolder). Single role means the file is for a Device or Host.
*.ssh	SAS Search configuration File
*.stc	SATA Protocol Analyzer/Capture Project/Viewer file (in the Examples folder “EasyCaptr”, “AdvanceCaptr”, or “Exerciser” subfolders)

*.std	Target Emulator file (in the Examples folder “Target Emulator” subfolder)
*.sts	SATA Sample file (in the SATA Examples folder “Sample” subfolder)
*.tsh	SATA Search configuration file
*.wss	SAS Workspace file (in the SAS System folder “Predefined\Workspace” subfolder)
*.wst	SATA Workspace file (in the SATA System folder “PreDefined\Workspace” subfolder)

Example Projects

The Analyzer includes example projects that you can use to perform an immediate analysis without any setup.

The Analyzer system software has a pre-defined folder (directory) structure for storing all files. All example files are in the Examples folder under the Sierra M6-1 folder.

It is strongly recommended that you open some example files to see types of projects that you can create.

Run an Example Analysis Project

To run an example project:

1. Select **File > Open.**
2. Locate example analysis projects by looking in the Examples folder. Examples are available for AdvanceCaptr, EasyCaptr, Exerciser, PatternGenerator, Samples, Target Emulator, and User Define Decoding Script.
3. In the EasyCaptr folder, choose an example ***.sac** file and click **Open** to display the example project dialog.

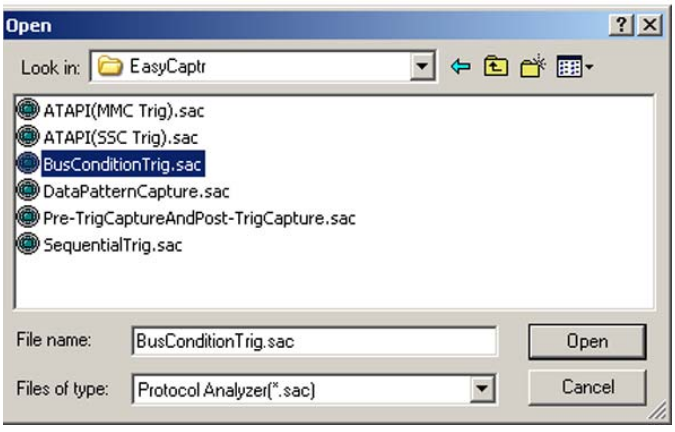


Figure 2.13: File Open Dialog

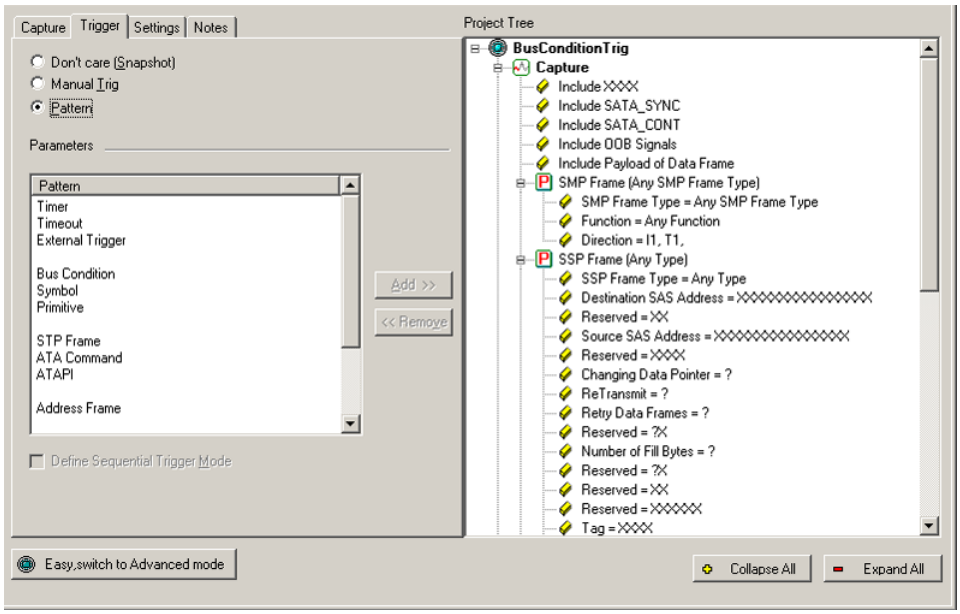


Figure 2.14: SAS: Sample Protocol Analysis Project

SAS vs. SATA: For Pattern Parameters, SATA Dialog adds FIS, FIS Pattern, and ATA Command Pattern and does not have STP Frame, SSP Frame, SMP Frame, and Address Frame.

4. Click the **Record** button to execute the pre-defined example.

5. After the project runs, you see an analyzer trace capture display similar to the one shown in Figure 2.15.

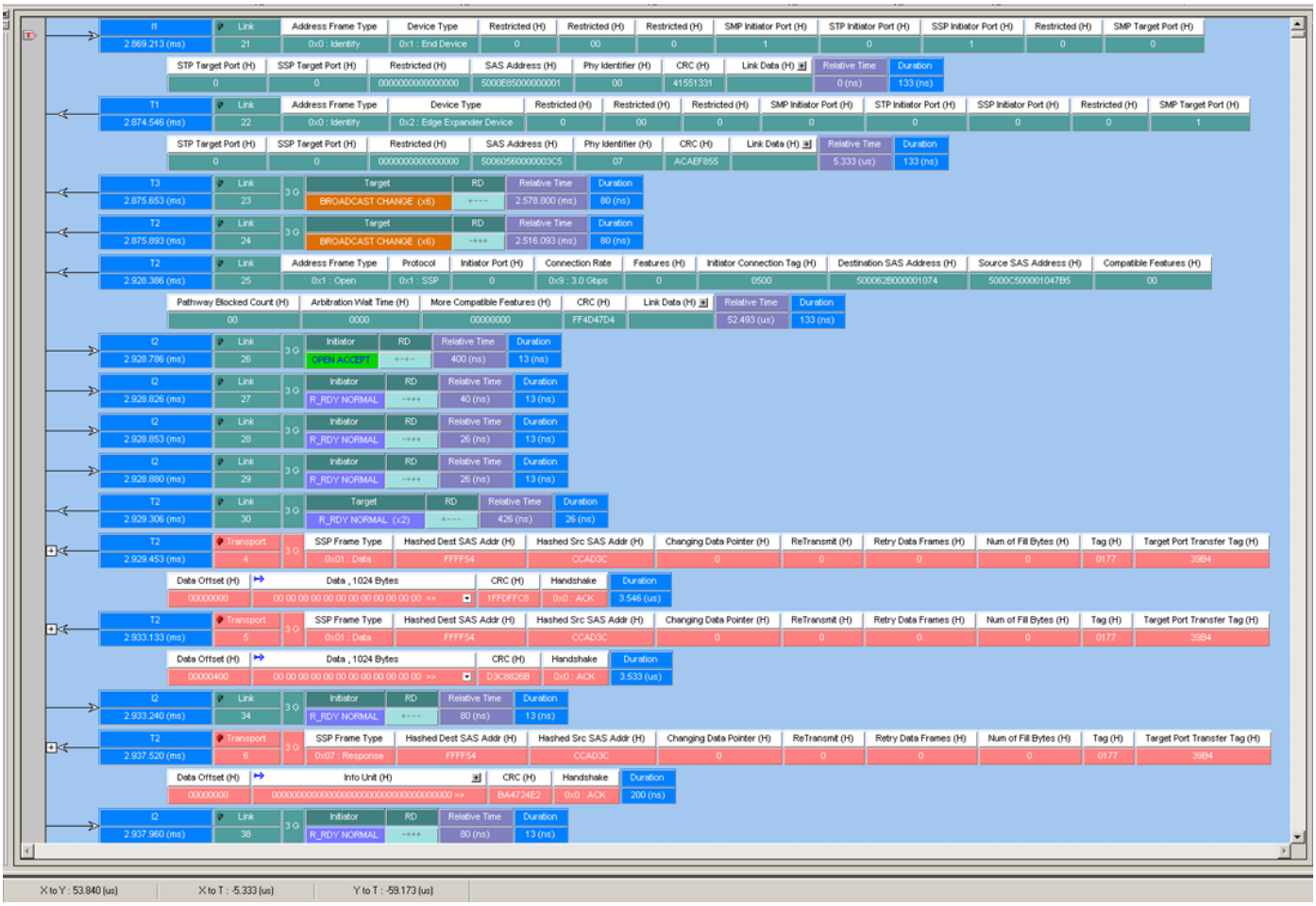


Figure 2.15: SAS: Analyzer Trace Capture Display

For details about the results display, see “Display Manipulation” on page 113 and see “Display Configuration” on page 195.

Patterns and Data Capture Setup

You can refine data capture by choosing **Pattern** and then selecting specific patterns for capture. Additionally, you can define a different set of patterns to capture after trigger.

To define specific patterns for capture, click the **Pattern** button to display the Capture tab for Pattern.

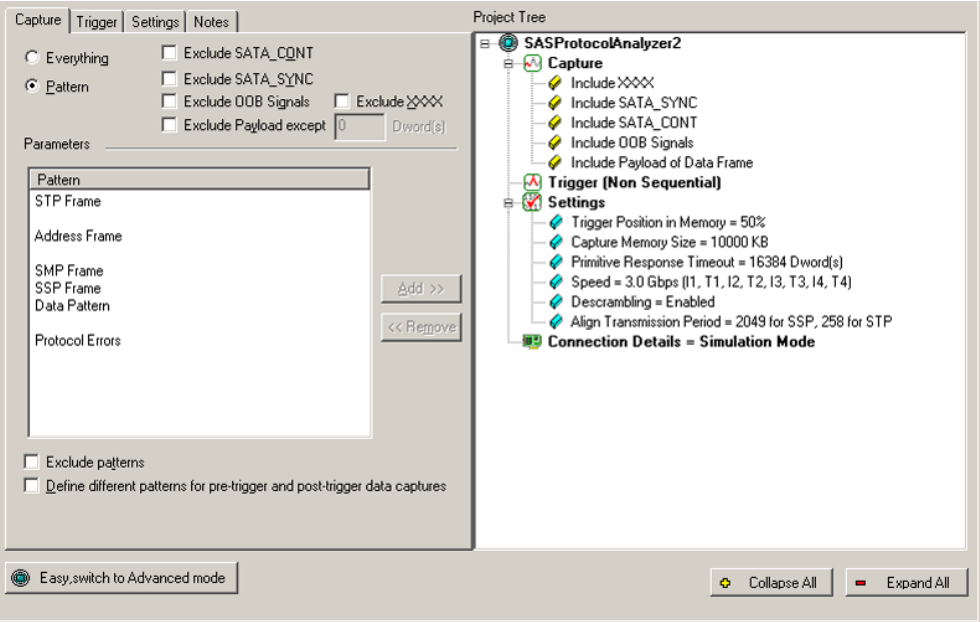


Figure 2.16: SAS: Choosing Capture Patterns

SAS vs. SATA: SATA Dialog replaces “Exclude SATA_CONT” with “Exclude CONT” and “Exclude SATA_SYNC” with “Exclude SYNC”.

SAS: The SAS Parameters window displays the following pattern capture categories:

- STP Frame
- Address Frame
- SMP Frame
- SSP Frame
- Data Pattern
- Protocol Errors

SATA: The SATA Parameters window displays the following pattern capture categories:

- FIS
- FIS Pattern
- Data Pattern
- Protocol Errors

Choose a Parameter

To choose a parameter for capture from any of these categories, highlight the category in the parameter window and click the **Add>>** button. This opens selection dialogs for each of the categories displaying all of the parameters for that category. All patterns added appear in the Project Tree.

Exclude Patterns

Check this box to allow for the capture of everything except the patterns that have been added to the Project Tree.

When you check this box, the Primitive category appears in the Parameter window, and the window enables the Exclude Idle checkbox.

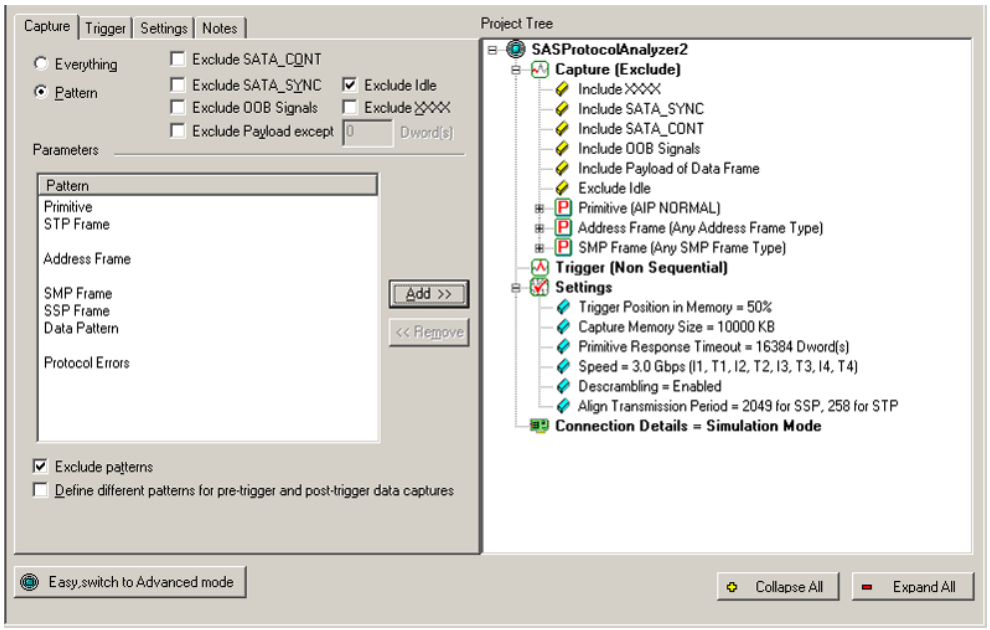


Figure 2.17: SAS: Exclude Patterns Checked

SAS vs. SATA: SATA Dialog replaces “Exclude SATA_CONT” with “Exclude CONT” and “Exclude SATA_SYNC” with “Exclude SYNC”. SATA Dialog has different Pattern Parameters (see “Patterns and Data Capture Setup” on page 53).

To remove an item from capture, highlight it in the Project tree and click the **<<Remove** button.

Pre and Post Trigger Data Capture

You can define one set of patterns for capture prior to the occurrence of a trigger and another set of patterns for capture after the occurrence of a trigger. The selection and setup procedure is the same for both Pre-Trigger capture and Post-Trigger capture.

Check **Define different patterns for pre-trigger and post-trigger data capture** to enable the Pre-Trigger Capture and Post-Trigger Capture tabs (instead of only the Capture tab).

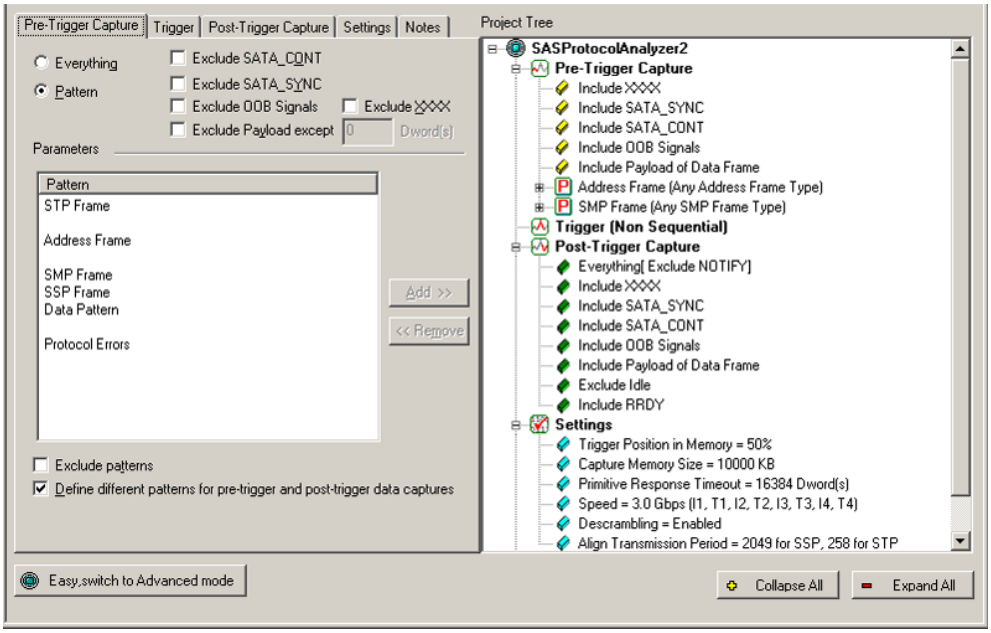


Figure 2.18: SAS: Post-trigger Capture Dialog Enabled

SAS vs. SATA: SATA Dialog replaces “Exclude SATA_CONT” with “Exclude CONT” and “Exclude SATA_SYNC” with “Exclude SYNC”. SATA Dialog has different Pattern Parameters (see “Patterns and Data Capture Setup” on page 53).

Defining Patterns

To select an item for capture, either highlight the category and click the **Add>>** button, or double-click the category, to open a corresponding definition dialog. You can define patterns for specific ports by checking or unchecking the Port ID.

Primitive

Double-click Primitive (available only if you check Exclude Patterns) to open the Primitive selection dialog.

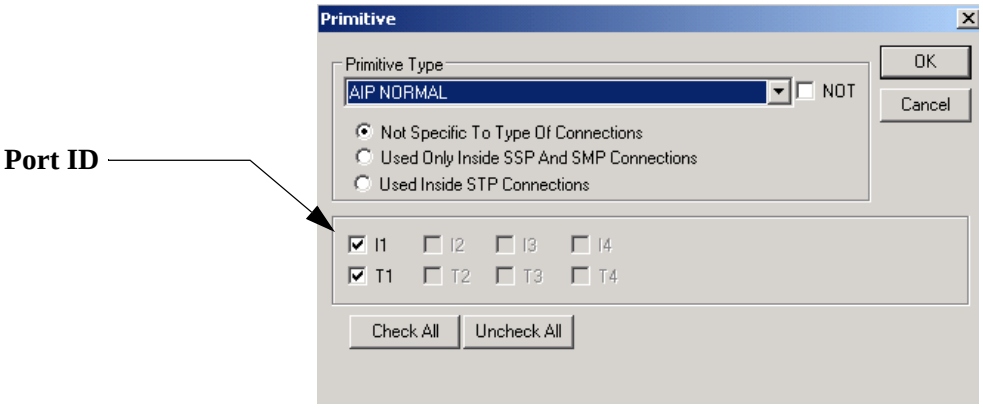


Figure 2.19: SAS: Primitive Dialog

SAS vs. SATA: SATA Dialog has no radio buttons and has different drop-down options.

Click the down arrow next to the Primitive drop-down list box, choose a Primitive to exclude, and click **OK**. Repeat for additional Primitives.

Data Pattern

Double-click Data Pattern to open the Data Pattern definition dialog.

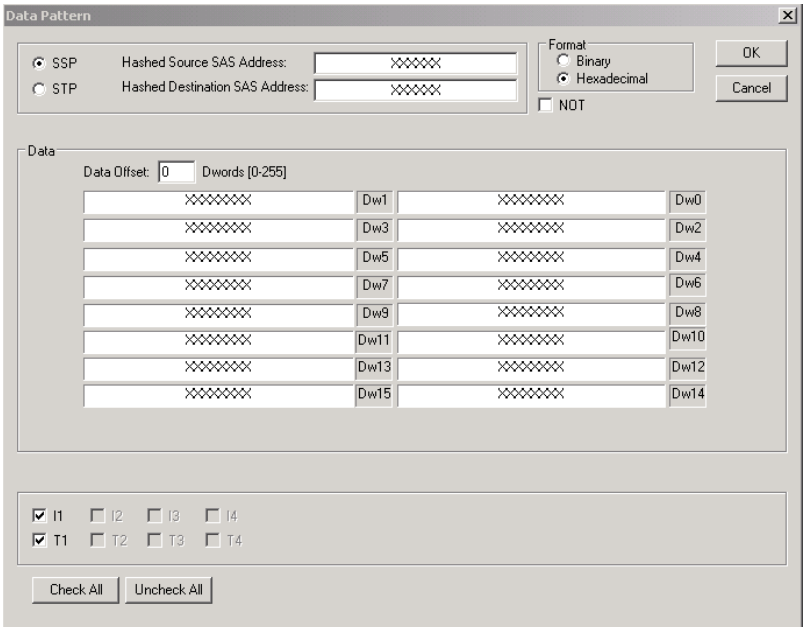


Figure 2.20: SAS: Data Pattern Dialog

SAS vs. SATA: SATA Dialog shows Port at the top and does not show SSP or STP.

Define the data pattern for capture or exclusion from capture and click **OK**.

Note: When entering the data pattern in the "Data" section of this screen, if you are reading the data pattern from a recorded trace, you must reverse the order of the bytes listed for each DWORD entered. For example, if you want to capture (or exclude) "00 01 02 03" (as displayed in the trace), you must enter this pattern as "03 02 01 00".

Protocol Errors

Double-click Protocol Errors to open the Protocol Errors selection dialog.

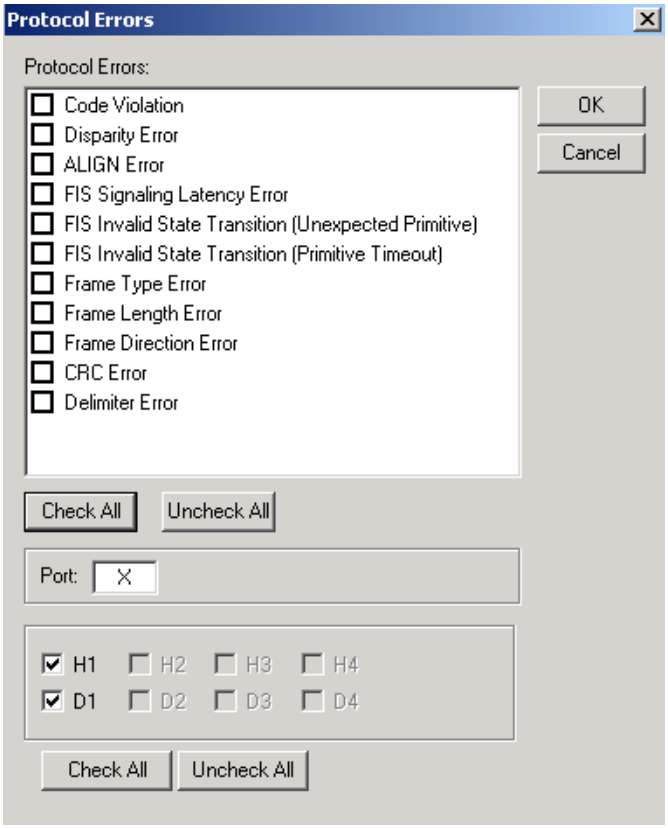


Figure 2.21: SAS: Protocol Errors Dialog

SAS vs. SATA: SATA dialog does not show ACK/NAK Timeout and has FIS signal-latency and state-transition errors, not STP ones.

Check protocol error(s) to omit or not capture, then click **OK**.

Protocol Errors

Code Violation: Wrong 10b symbol detected.

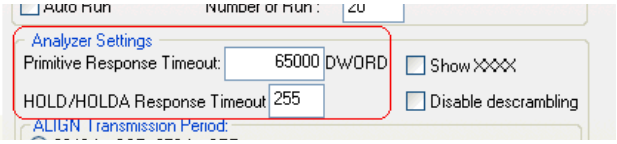
Disparity Error: Wrong disparity detected.

ALIGN Error: ALIGN primitive frequency is outside the specification requirements.

STP Signaling Latency Error [SAS only] or **FIS Signaling Latency Error [SATA only]**: DWORD difference between HOLD and HOLDA is greater than entered value in the HOLD/HOLDA Response Timeout field.

STP Invalid State Transition (Unexpected Primitive) [SAS only] or **FIS Invalid State Transition (Unexpected Primitive) [SATA only]**: Second SATA_SOF is encountered before SATA_EOF, and other unexpected primitives.

STP Invalid State Transition (Primitive Timeout) [SAS only] or **FIS Invalid State Transition (Primitive Timeout) [SATA only]**: Timeout between two paired primitives is above entered value. 65000 DWORDs is default. For example, it can occur between WTRM and R_OK, or X_RDY and R_RDY. It expects device (or host) to send a response, but response is not received after 65000 DWORDs. You set Primitive Response Timeout and HOLD/HOLDA Response Timeout in the Settings tab Analyzer Settings section.



Frame Type Error: Wrong frame type.

Frame Length Error: Reported frame length is different than actual frame length.

Frame Direction Error: Wrong frame direction. For example, Register Device to Host coming from the Host.

CRC Error: CRC error detected.

ACK/NAK Timeout [SAS only]: ACK or NAK primitive missing or encountered unexpectedly.

Disable "Disparity Error" and "Symbol Violation" during the Speed negotiation: No longer detects Code Violation or Disparity Error.

Delimiter Error: Detects two SOF primitives without an EOF between them. Also detects two EOF primitives without an SOF between them.

STP Frame (SAS only)

Double-click STP Frame to open the FIS Patterns dialog.

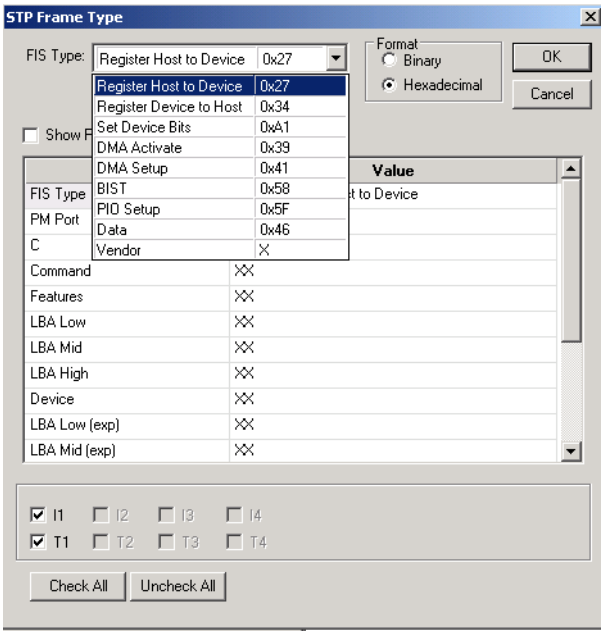


Figure 2.22: SAS: FIS Patterns Dialog

SAS vs. SATA: Not available in SATA.

Click the down arrow next to the Type drop-down list box, choose an FIS type to capture or exclude, and click **OK**. Repeat for additional types.

Available FIS Types

- Register Host to Device
- Register Device to Host
- Set Device Bits
- DMA Activate
- DMA Setup
- BIST
- PIO Setup
- Data
- Vendor

Address Frame (SAS only)

Double-click Address Frame to open the Address Frame Type Pattern dialog.

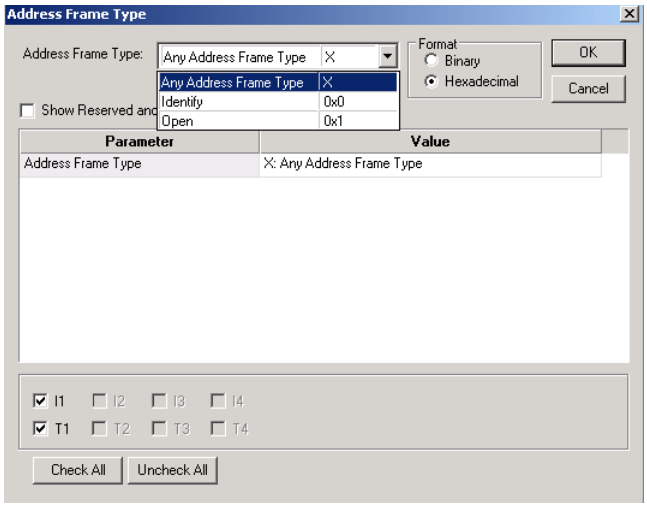


Figure 2.23: SAS: Address Frame Type Pattern Dialog

SAS vs. SATA: Not available in SATA.

Click the down arrow next to the Address Frame Types list box and choose an address frame type.

SMP Frame (SAS only)

Double-click SMP Frame to open the SMP Frame Pattern dialog.

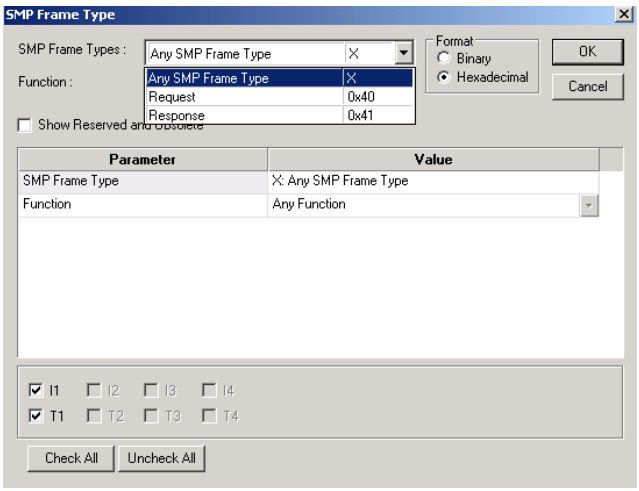


Figure 2.24: SAS: SMP Frame Pattern Dialog

SAS vs. SATA: Not available in SATA.

Click the down arrow next to the SMP Frame Type list box and choose a frame type. Assign a specific function to the frame by clicking the down arrow next to the Function list box and choose a function.

SSP Frame (SAS only)

Double-click SSP Frame to open the SSP Frame Pattern dialog.

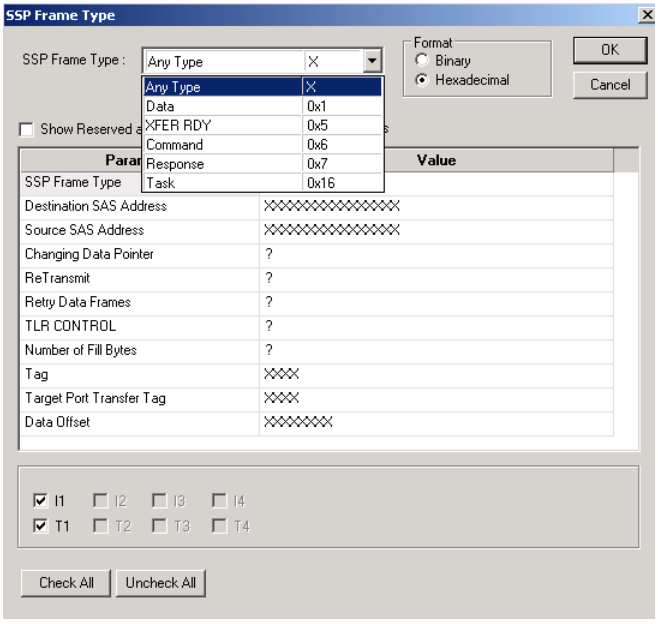


Figure 2.25: SAS: SSP Frame Type Dialog

SAS vs. SATA: Not available in SATA.

Click the down arrow next to the SSP Frame Type list box and choose an SSP Frame type.

FIS (Frame Information Structure) (SATA only)

Double-click FIS to open the FIS Type selection dialog.

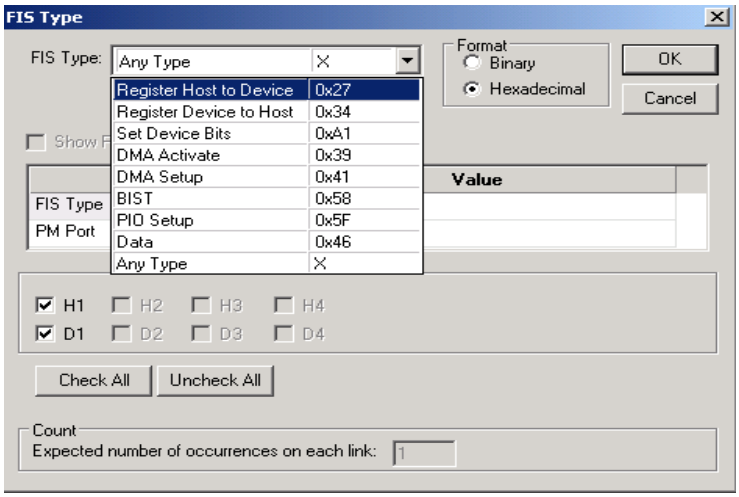


Figure 2.26: SATA: FIS Types Dialog

SAS vs. SATA: Not available in SAS.

Click the down arrow next to the Type drop-down list box, choose a **FIS** type to capture, and click **OK**. Repeat for additional types.

Available FIS Types

- Register Host to Device
- Register Device to Host
- Set Device Bit
- DMA Activate
- DMA Setup
- BIST
- PIO Setup
- Data
- Any Type

FIS Pattern (SATA only)

Double-click **STP Frame** to open the STP Frame selection dialog.

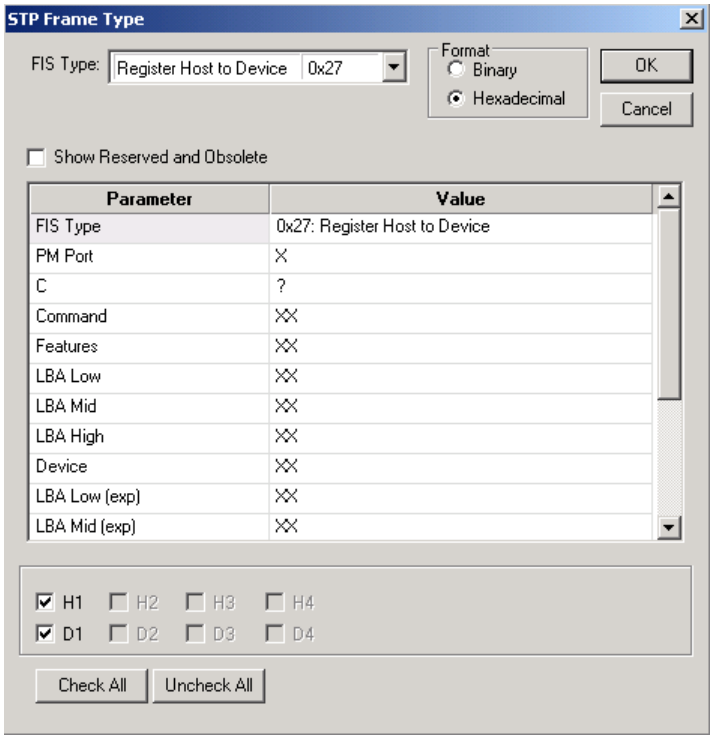


Figure 2.27: SATA: FIS Pattern Dialog

SAS vs. SATA: Not available in SAS.

The FIS Pattern dialog opens with the default FIS Type as **Register Host to device.** To choose another available FIS Type, click the down arrow next to the FIS Type list box.

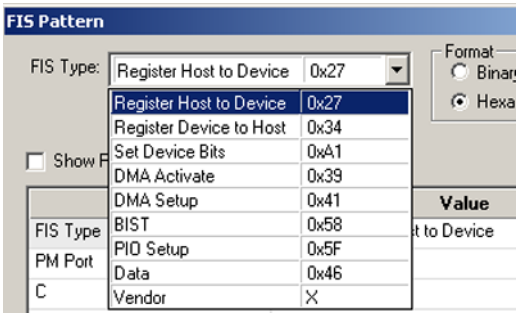


Figure 2.28: SATA: FIS Pattern Dialog Dropdown

SAS vs. SATA: Not available in SAS.

Choose FIS Type and complete the corresponding dialog.

FIS Types (SAS and SATA)

If you select STP Frame (SAS) or FIS Pattern (SATA) for the Pattern, the FIS Pattern window opens. You can select the FIS Type in this window from among the following types.

Register Host to Device

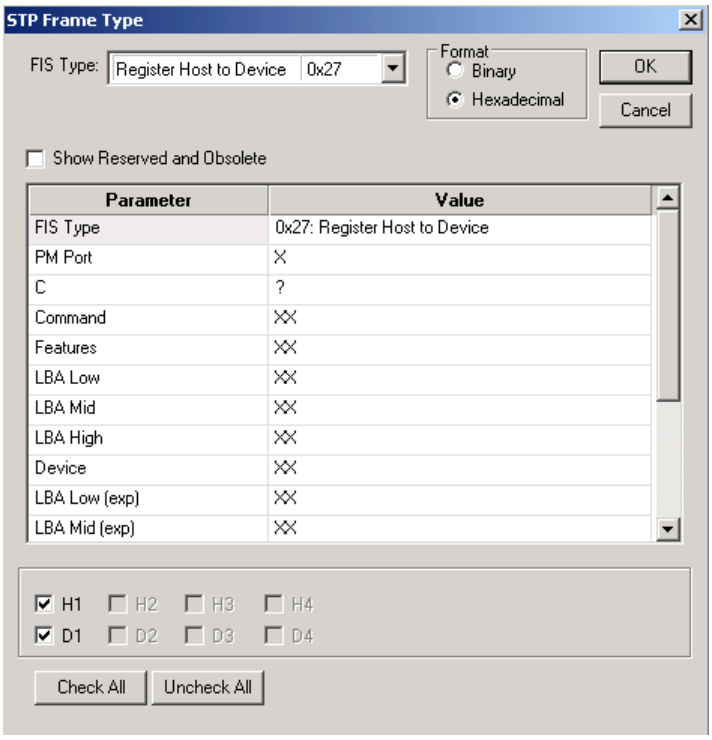


Figure 2.29: Register Host to Device

Register Device to Host

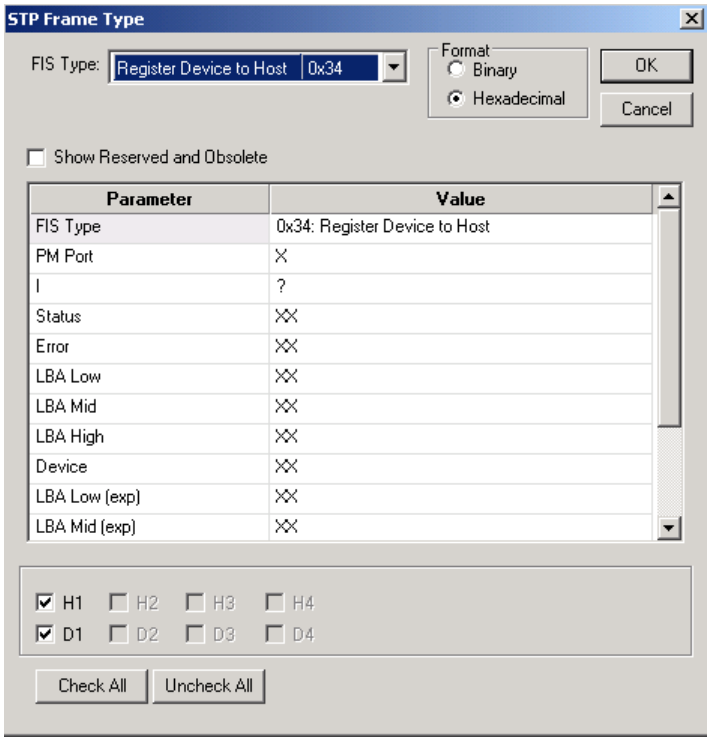


Figure 2.30: Register Device to Host

Set Device Bits

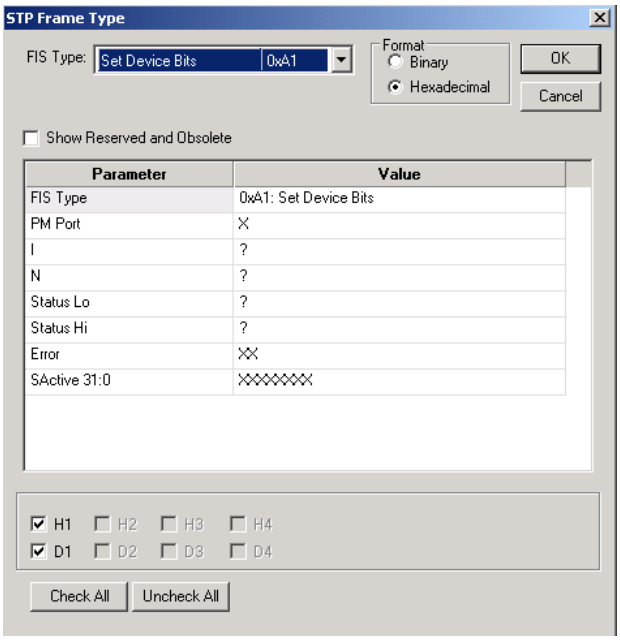


Figure 2.31: Set Device Bits

DMA Activate

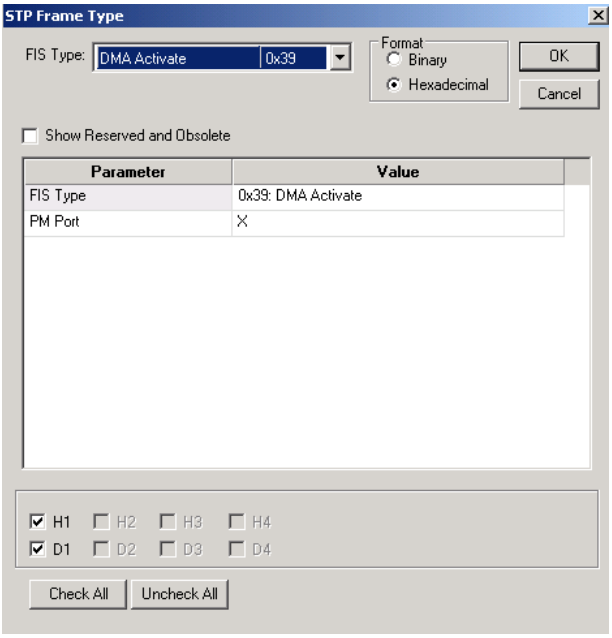


Figure 2.32: DMA Activate

DMA Setup

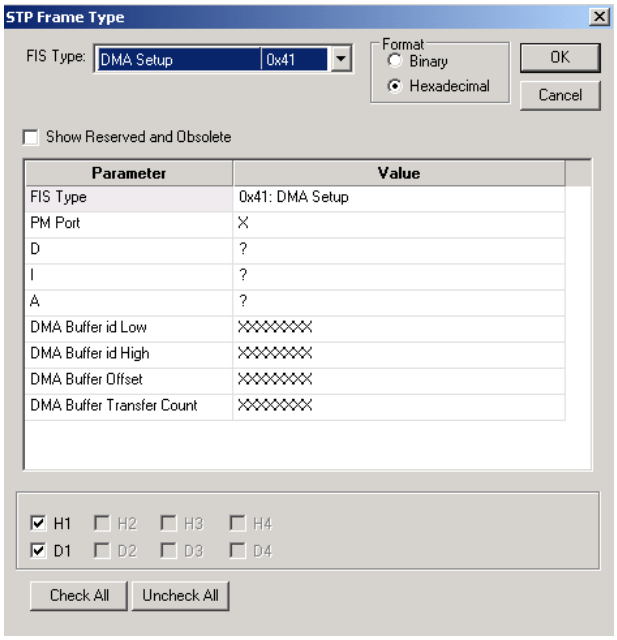


Figure 2.33: DMA Setup

BIST

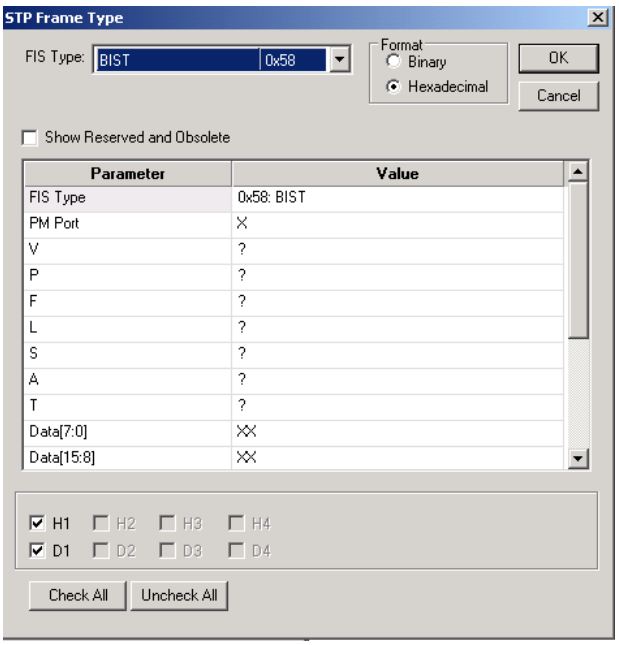


Figure 2.34: BIST

PIO Setup

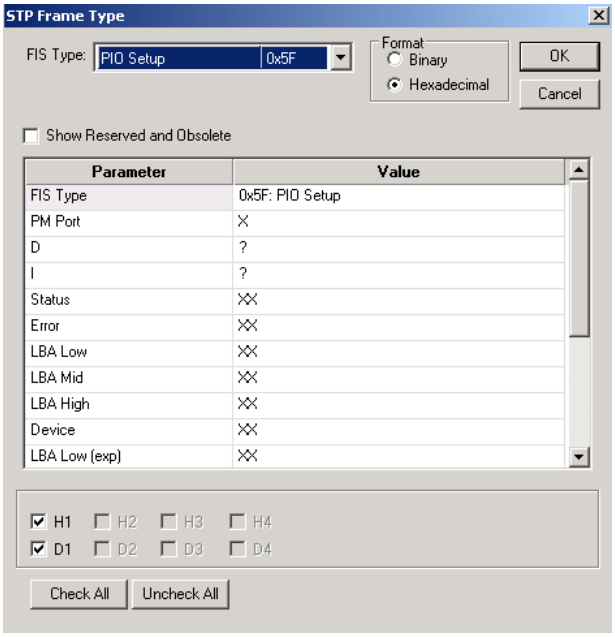


Figure 2.35: PIO Setup

Data

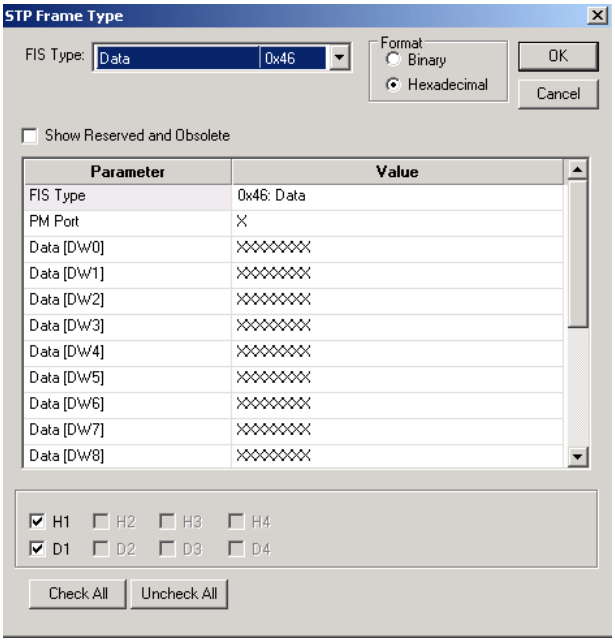


Figure 2.36: Data

Vendor

Vendor is for FIS Pattern.

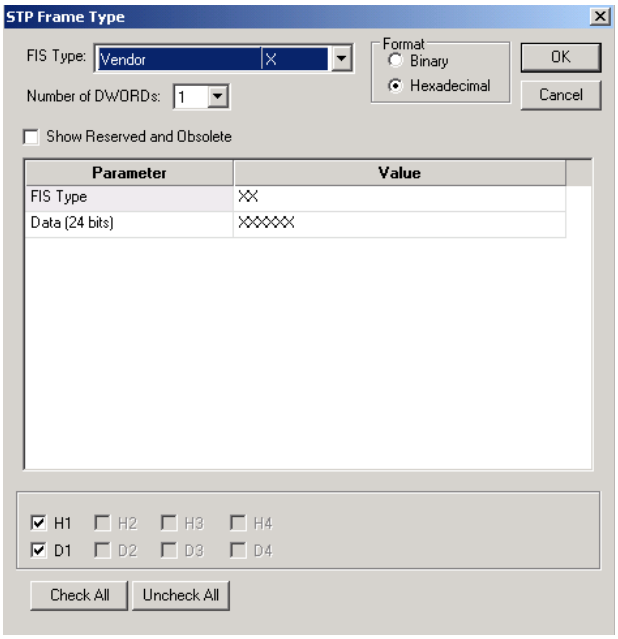


Figure 2.37: Vendor

Trigger Setup

The **Trigger** tab in the analysis project dialog allows you to specify when the analyzer completes a data capture. Three trigger modes are available: The default **Don't care (Snapshot), Manual Trig,** and **Pattern.**

When data capture starts with **Don't care (Snapshot)** selected, the analyzer triggers on the first data pattern on the bus.

Starting a data capture with **Pattern** selected triggers when specific pattern(s) are detected in the captured data stream. The following three ways can trigger the analyzer with **Pattern** selected.

- Trigger on any pattern (Any Trigger Mode)
- External Trigger
- Trigger on a sequence of patterns (Sequential Trigger Mode)

Snapshot Mode

To trigger immediately on any pattern, check the **Don't care (Snapshot)** button.

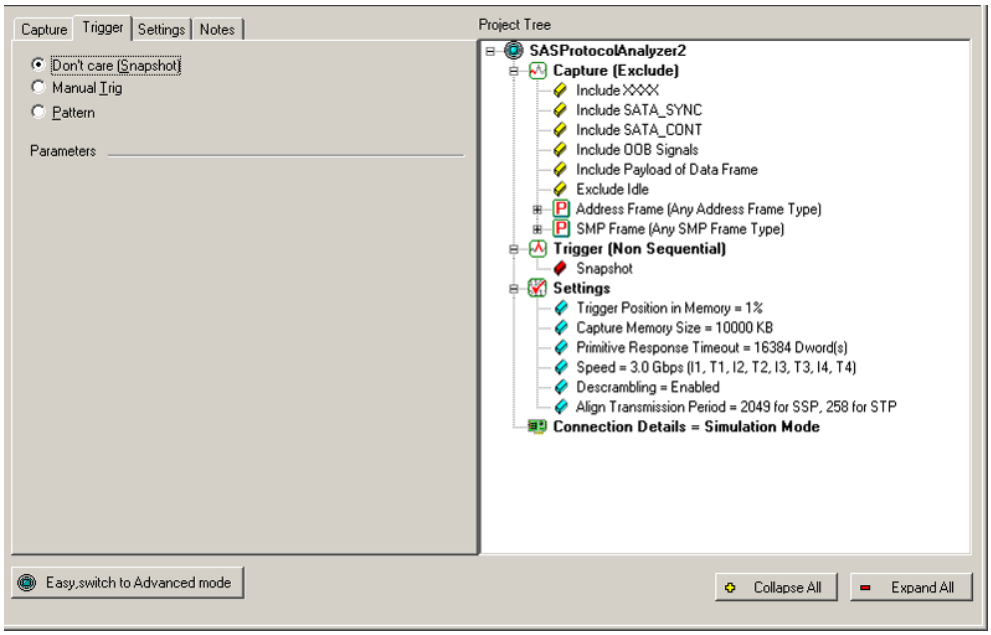


Figure 2.38: Default Trigger Selected

Manual Trigger Mode

In the **Manual Trigger** mode, the analyzer captures bus traffic continually from when you use the Manual Trigger until you click the **Stop Hardware** button (on the analyzer toolbar), which triggers the analyzer. To perform a manual trigger, check the **Manual Trig** button.

Any Trigger Mode

In **Any Trigger** mode, the Analyzer triggers whenever any of the patterns selected for triggering occurs (an OR condition). The procedure for selecting trigger parameters is identical to that for selecting capture parameters. All items selected for triggering appear in the Project Tree.

To define patterns for triggering, check the **Pattern** button in the Trigger dialog.

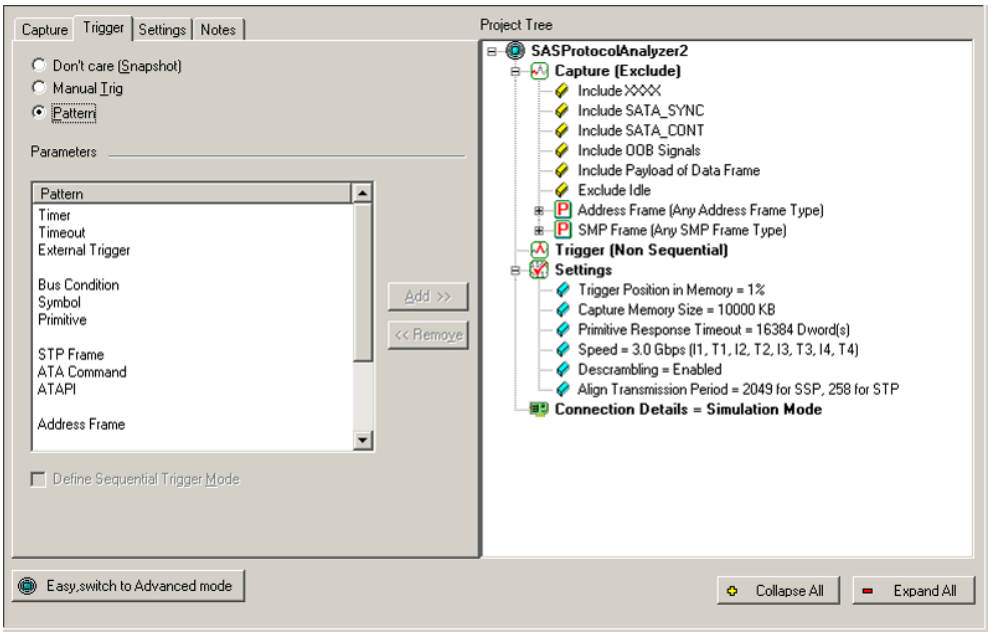


Figure 2.39: SAS: Select Patterns for Trigger

The SAS **Parameters** window displays the following trigger pattern categories:

- Timer
- Timeout
- External Trigger
- Bus Condition
- Symbol
- Primitive
- STP Frame
- ATA Command
- ATAPI
- Address Frame
- SMP Frame
- SSP Frame
- SCSI Command
- Data Pattern
- Protocol Errors

The SATA **Parameters** window displays the following trigger pattern categories:

- Timer
- Timeout
- External Trigger
- Bus Condition
- Symbol
- Primitive
- FIS
- FIS Pattern
- ATA Command
- ATA Command Pattern
- ATAPI
- Soft Reset
- Data Pattern
- Protocol Errors

Note: In packet view, you can right-click on any frame, select **Add to Trigger**, and add the pattern to **DataPatternCapture** to make it a trigger pattern.

Choosing a Parameter

Either highlight the category and click the Add>> button, or double-click the category, to open a corresponding definition dialog.

To remove an item, highlight it in the Project Tree, then click the **<<Remove** button.

Triggering on a Timer

Selecting a timer for a trigger in the **Any Trigger Mode** limits the time that the analyzer looks for selected triggering conditions before triggering. The timer activates when the Project runs. If none of the selected triggering conditions occurs during the timer's active time, the Analyzer triggers at the end of the time set for the timer.

You can set a timer independently of any other trigger selection, to cause an unconditional trigger after a set time.

To set the timer value, double-click **Timer** in the Pattern window to open the Timer dialog.

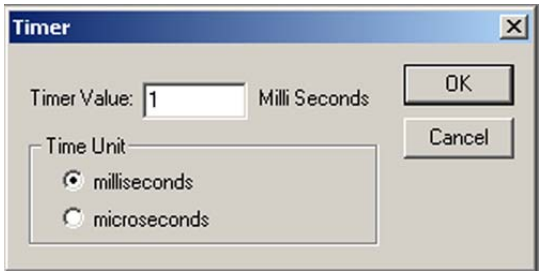


Figure 2.40: Timer Dialog

Check a Time Unit, enter the Timer Value, and click OK.

Timeout

Selecting **Timeout** for the pattern opens the Timeout Pattern dialog.

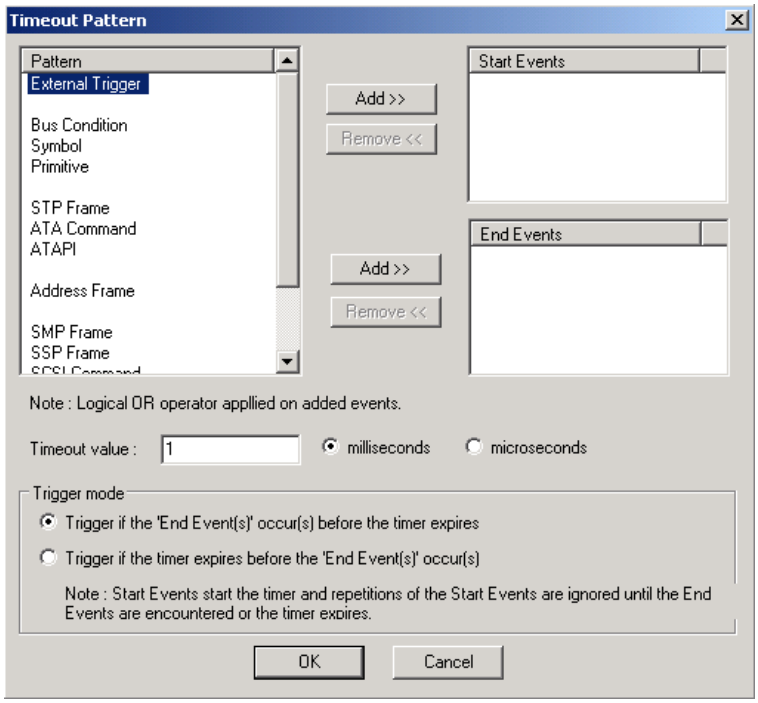


Figure 2.41: Timeout Dialog

"Start Events" starts the timer in Timeout Trigger and "End Events" triggers the analyzer (if first trigger mode is selected) or resets the trigger (if second trigger mode is selected). Repetitions of the Start Events are ignored until the End Event is encountered or the timer expires.

Select a pattern for Start Events or End Events, enter a Timeout value, then select Trigger Mode:

- If End Events occur before timer expires
- If timer expires before End Events

Note: You cannot select a Timeout pattern if you select any other pattern as the trigger condition.

External Trigger

You can trigger on an external trigger. To set up the trigger, click the **External Trigger** category.

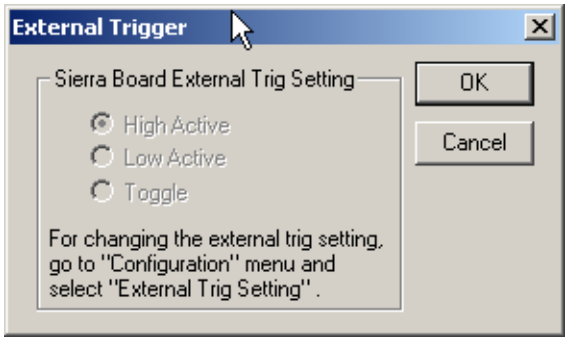


Figure 2.42: External Trigger Dialog

You cannot select an External Trigger Setting, so click **OK**.

Bus Condition

Double-click **Bus Condition** in the Pattern window to open the Bus Conditions dialog.

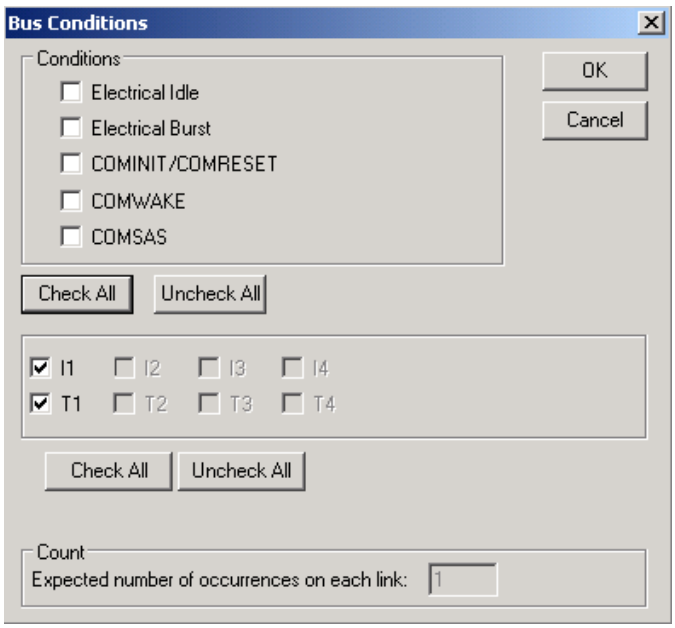


Figure 2.43: SAS: Bus Conditions Dialog

SAS vs. SATA: SATA Dialog separates the COMINIT and COMRESET check boxes and replaces COMWAKE with Host COMWAKE and COMSAS with Device COMWAKE.

Check Conditions on which to trigger, then click **OK**.

Note: You can define triggering for specific ports by checking or unchecking Port IDs.

Symbol

Double-click **Symbol** in the Pattern window to open the Symbol dialog.

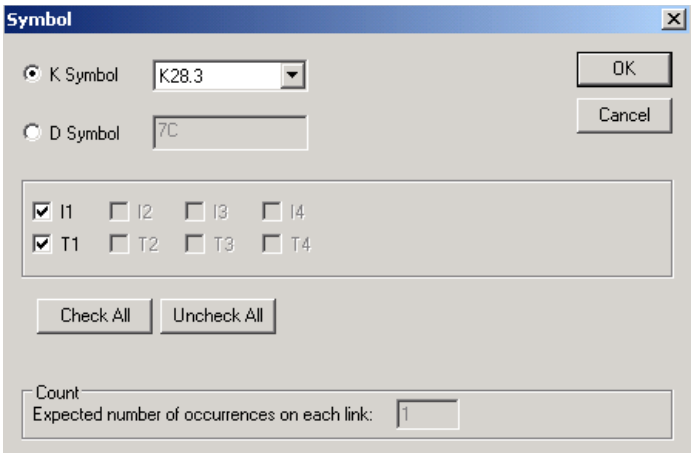


Figure 2.44: Symbol Dialog

Choose a symbol type by checking either the K Symbol or D Symbol option, then click the down arrow in the Symbol dropdown list, choose a symbol to trigger on, and click **OK**. Note that the D Symbol choice does not have a down arrow.

Primitive

Double-click Primitive in the Pattern window to open the Primitive dialog.

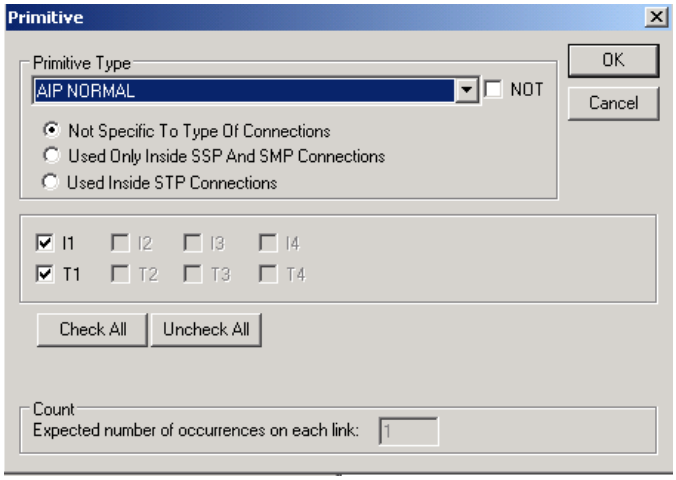


Figure 2.45: SAS: Primitive Dialog

SAS vs. SATA: SATA Dialog has no radio buttons and has different drop-down options.

Click the down arrow next to the Primitive dropdown list, scroll the list to choose a primitive on which to trigger, and click **OK**.

Note: Check the box to the right of the Primitive Type to use the logical NOT.

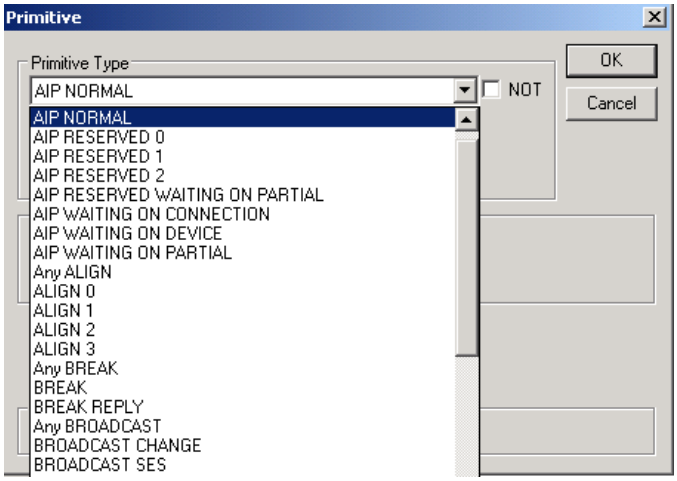


Figure 2.46: SAS: Primitive Selection Choices

SAS vs. SATA: SATA Dialog has different choices.

ATA Command

Double-click ATA Command in the Pattern window to open the ATA Command Pattern dialog.

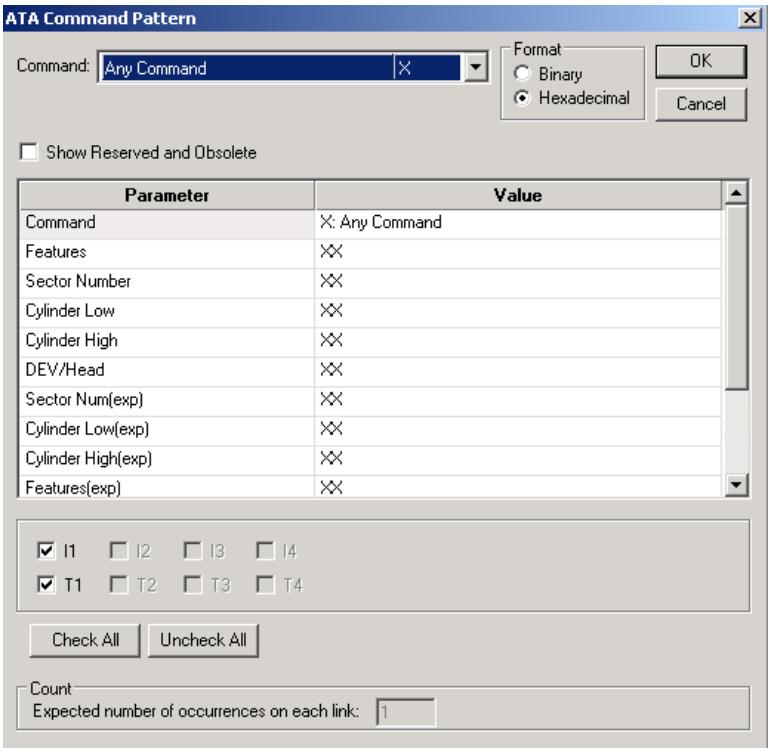


Figure 2.47: SAS: FIS Pattern Dialog

SAS vs. SATA: SATA Dialog has different dropdown options.

Click the down arrow next to the Command dropdown list, scroll the list to choose a command to trigger on, and click OK.

A powerful triggering choice is **Any Command**, which causes the analyzer to trigger on any ATA command.

ATAPI

Double-click ATAPI in the Pattern window to open the ATAPI Pattern dialog.

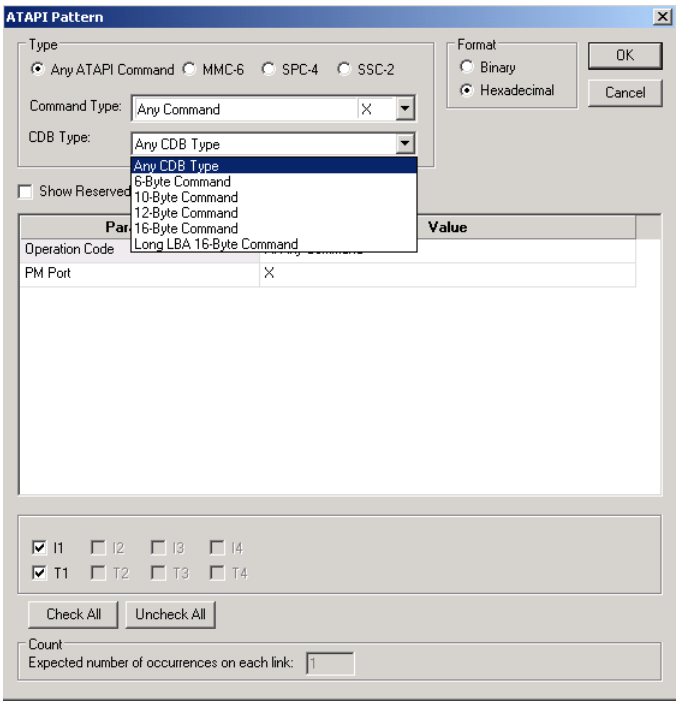


Figure 2.48: SAS: ATAPI Pattern Dialog

SAS vs. SATA: SATA Dialog has different dropdown options.

Click the down arrow next to the CDB dropdown list, scroll the list to choose a CDB Type, and click **OK**.

Data Pattern

Double-click Data Pattern in the Pattern window to open the Data Pattern dialog.

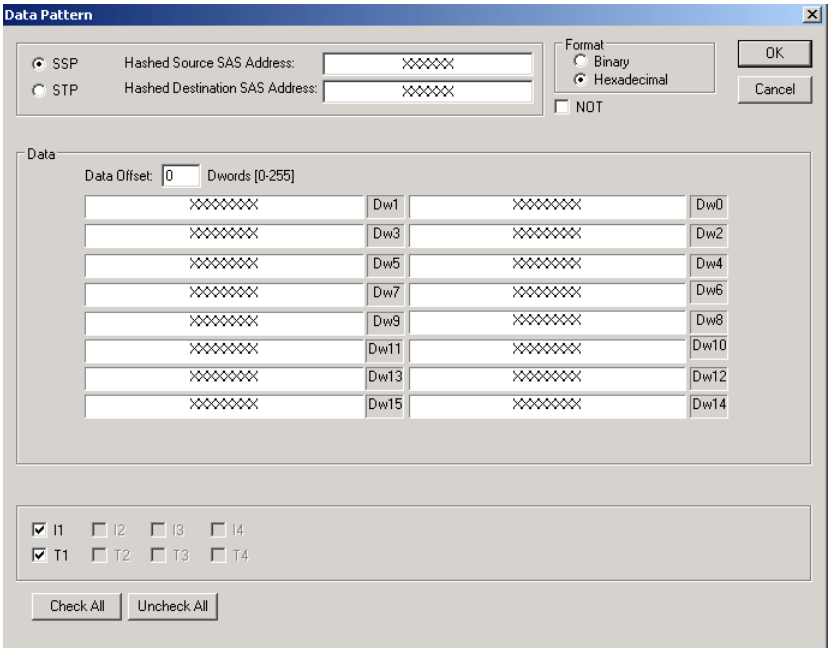


Figure 2.49: SAS: Data Pattern Dialog

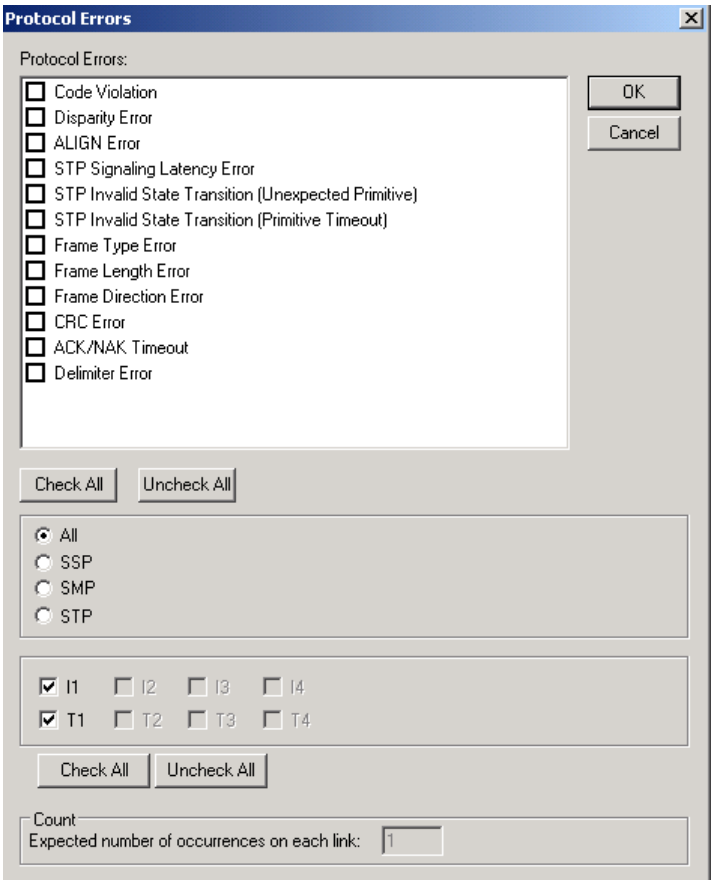
SAS vs. SATA: SATA Dialog shows Port at the top and does not show SSP or STP.

Define the data pattern for triggering and click **OK**.

Note: When entering the data pattern in the "Data" section of this screen, if you are reading the data pattern from a recorded trace, you must reverse the order of the bytes listed for each DWORD entered. For example, if you want to trigger on "00 01 02 03" (as displayed in the trace), you must enter this DWORD pattern as "03 02 01 00".

Protocol Errors

Double-click Protocol Errors in the Pattern window to open the Protocol Errors dialog.



SAS: Protocol Errors Dialog

SAS vs. SATA: SATA Dialog shows Port and does not show SSP, SMP, or STP radio buttons.

Check the protocol error(s) to trigger on and click **OK**.

STP Frame (SAS only)

Double-click **STP Frame** in the Pattern window to open the STP Frame dialog.

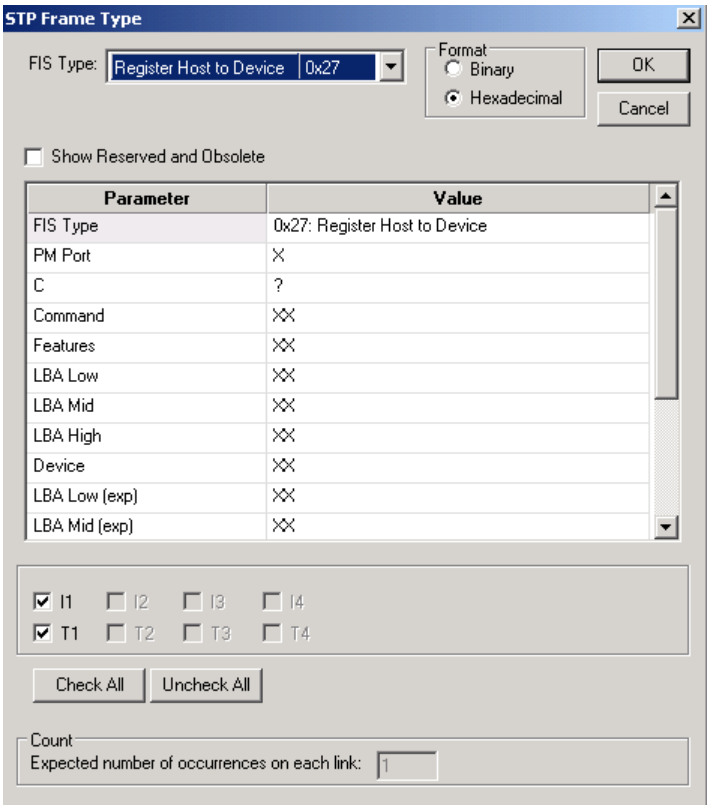


Figure 2.50: SAS: FIS Pattern Dialog

SAS vs. SATA: Not available in SATA.

Click the down arrow next to the FIS type dropdown list, scroll the list to choose an FIS type on which to trigger, and click **OK**.

Address Frame (SAS only)

Double-click Address Frame in the Pattern window to open the Address Frame Type Pattern dialog.

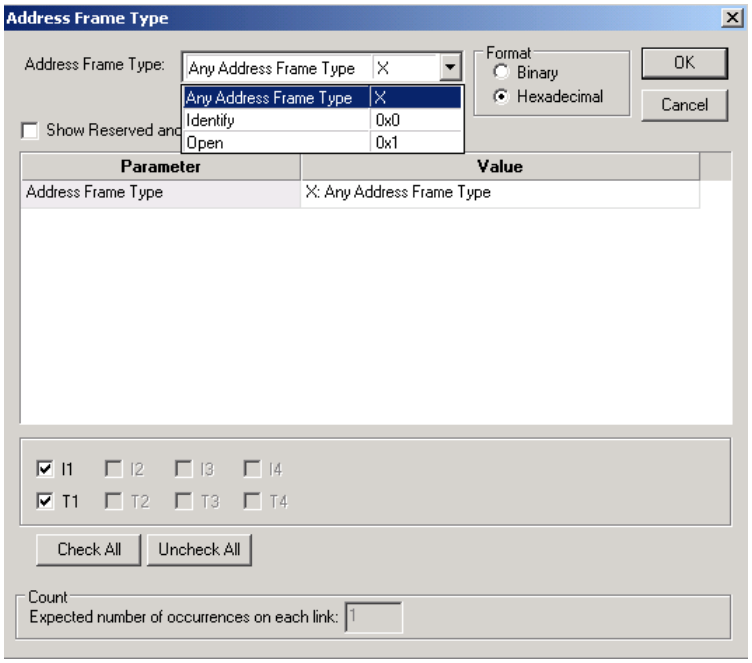


Figure 2.51: SAS: Address Frame Type Pattern Dialog

SAS vs. SATA: Not available in SATA.

Click the down arrow next to the Address Frame Type dropdown list, scroll the list to choose an address frame type on which to trigger, and click **OK**.

SMP Frame (SAS only)

Double-click SMP Frame in the Pattern window to open the SMP Frame Pattern dialog.

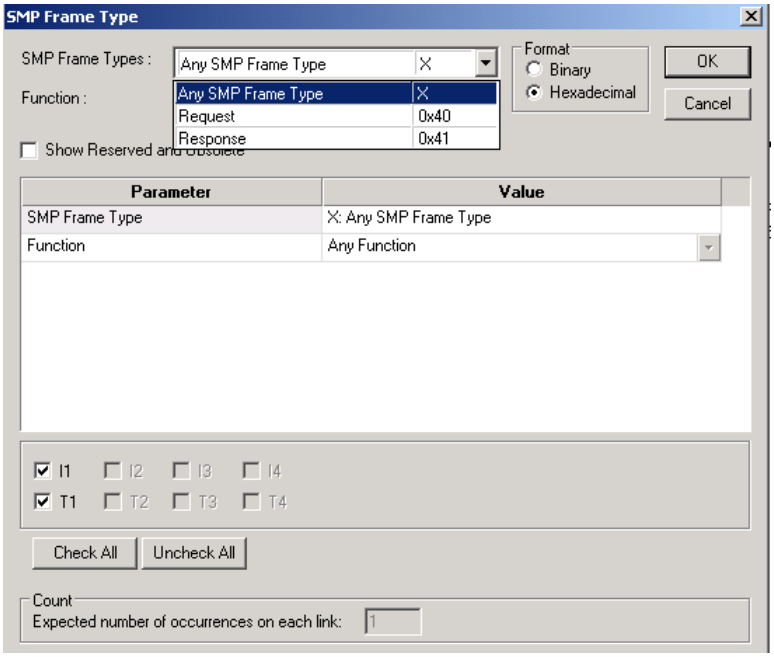


Figure 2.52: SAS: SMP Frame Pattern Dialog

SAS vs. SATA: Not available in SATA.

Click the down arrow next to the SMP Frame Types dropdown list, then scroll the list to choose an SMP frame type on which to trigger.

Then click the down arrow next to the Function dropdown list, choose a function, and click **OK**.

SSP Frame (SAS only)

Double-click SSP Frame in the Pattern window to open the SSP Frame Type dialog.

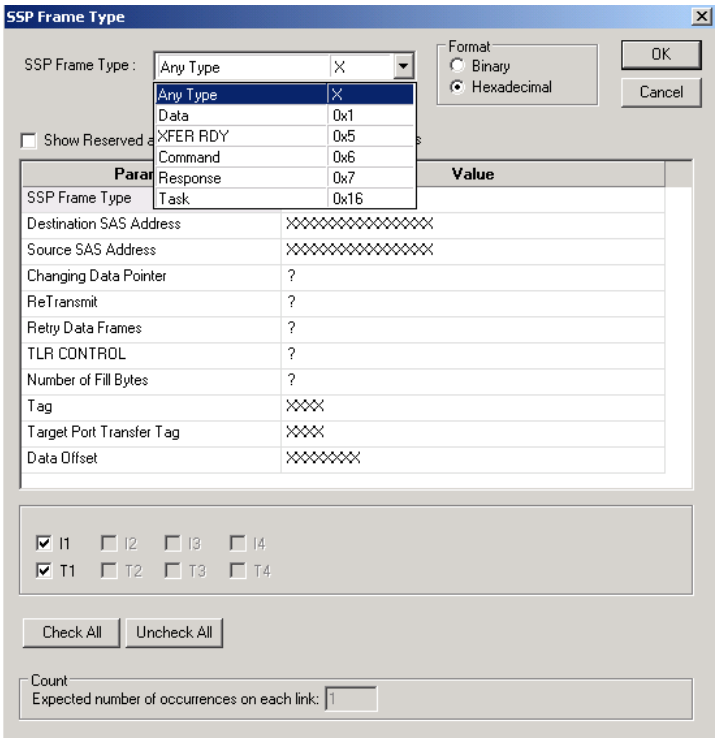


Figure 2.53: SAS: SMP Frame Type Dialog

SAS vs. SATA: Not available in SATA.

Click the down arrow next to the SSP Frame Type dropdown list, scroll the list to choose an SSP frame type on which to trigger, and click **OK**.

SCSI Command (SAS only)

Double-click SCSI Command in the Pattern window to open the SCSI Command Pattern dialog.

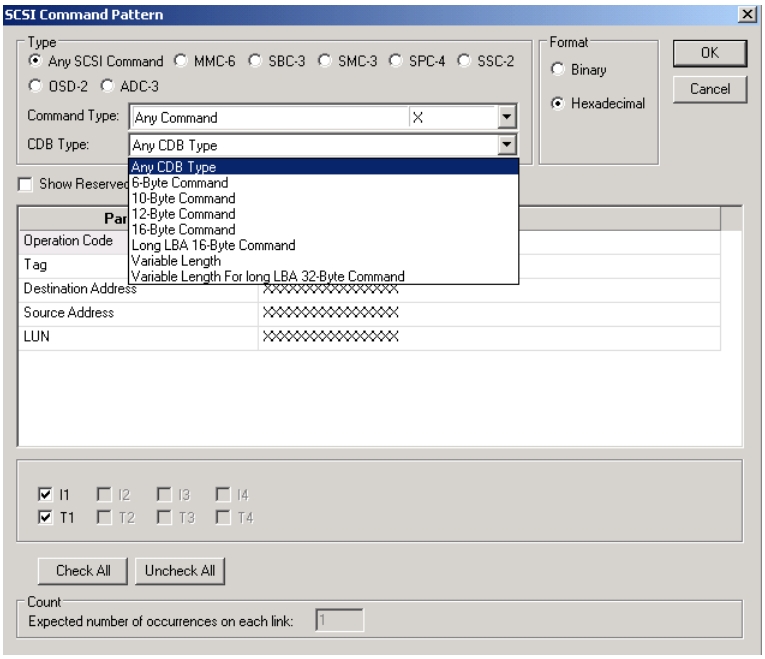


Figure 2.54: SAS: SCSI Command Pattern Dialog

SAS vs. SATA: Not available in SATA.

Click the down arrow next to the CDB dropdown list, scroll the list to choose a CDB Type, and click **OK**.

FIS (Frame Information Structure) (SATA only)

Double-click **FIS** to open the FIS Type selection dialog.

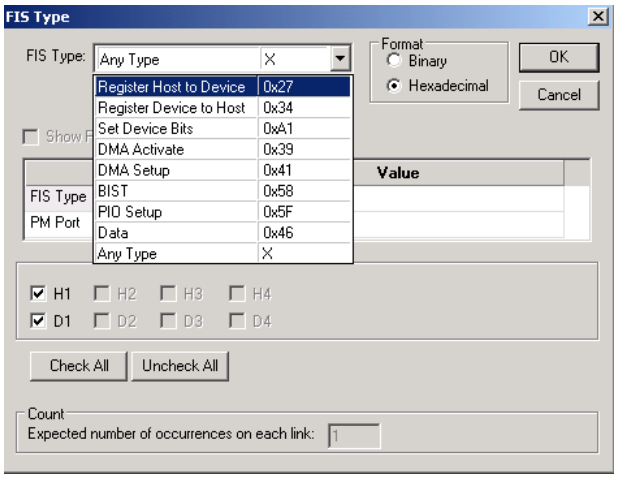


Figure 2.55: SATA: FIS Type Dialog

SAS vs. SATA: Not available in SAS.

Click the down arrow next to the Type drop-down list box, choose a **FIS** type on which to trigger, and click **OK.** Repeat for additional types.

Available FIS Types:

- Register Host to Device
- Register Device to Host
- Set Device Bit
- DMA Activate
- Any Type
- DMA Setup
- BIST
- PIO Setup
- Data

Note: You cannot trigger on a Vendor FIS.

FIS Pattern (SATA only)

Double-click **STP Frame** to open the FIS Type selection dialog.

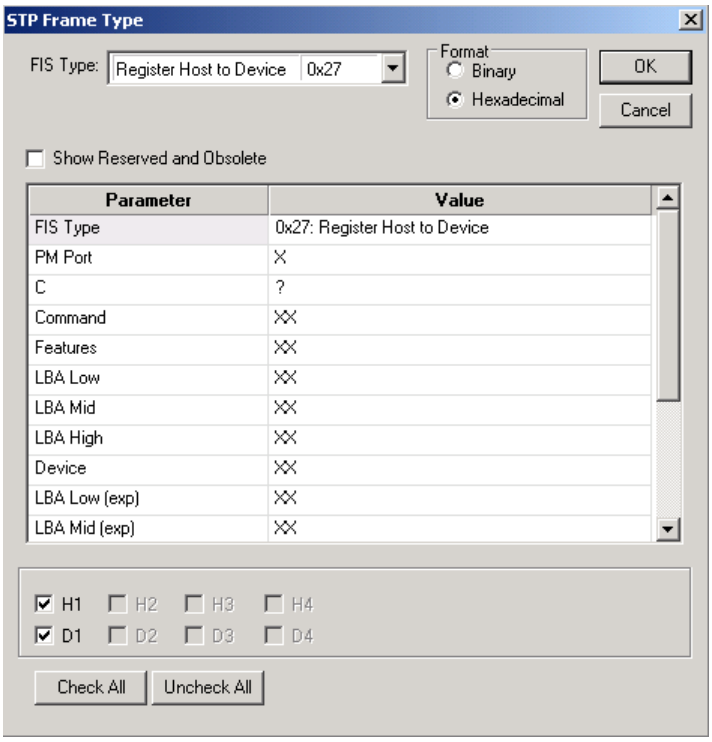


Figure 2.56: SATA: FIS Type Dialog

SAS vs. SATA: Not available in SAS.

The FIS Pattern dialog opens with the default FIS Type **Register Host to device.** To choose another available FIS Type, click the down arrow next to the FIS Type list box.

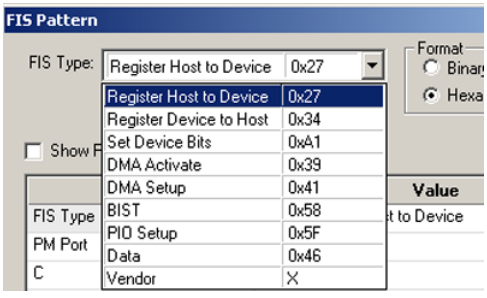


Figure 2.57: SATA: FIS Pattern Dialog Choices

SAS vs. SATA: Not available in SAS.

Choose an FIS Type and complete the corresponding dialog.

ATA Command Pattern (SATA only)

Double-click **ATA Command** to open the ATA Command Pattern selection dialog.

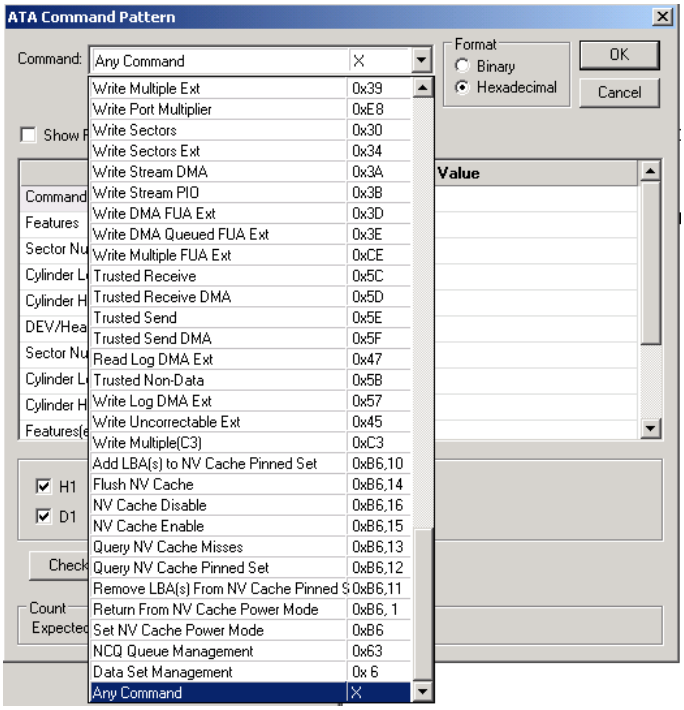


Figure 2.58: SATA: ATA Command Pattern Dialog

SAS vs. SATA: Not available in SAS.

Click the down arrow next to the Command list box, choose an ATA command, and click **OK**.

Soft Reset (SATA only)

Double-click **Soft Reset** to open the Soft Reset dialog.

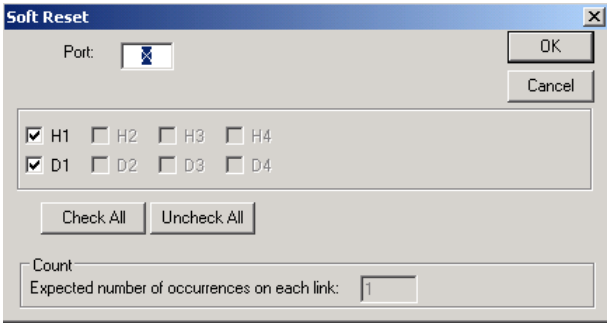


Figure 2.59: SATA: Soft Reset Dialog

SAS vs. SATA: Not available in SAS.

Sequential Trigger Mode

In Sequential Trigger mode, triggering occurs whenever the system detects a specific sequence of patterns. Defining the triggering patterns sets the sequence order. You must define at least two patterns to enable selection of Sequential Trigger mode.

Note: Patterns, such as Primitives and Symbols or Frames, occurring very close together on different ports, cause an error in triggering.

To define a triggering sequence, select more than one pattern, then check the **Define Sequential Trigger Mode** check box.

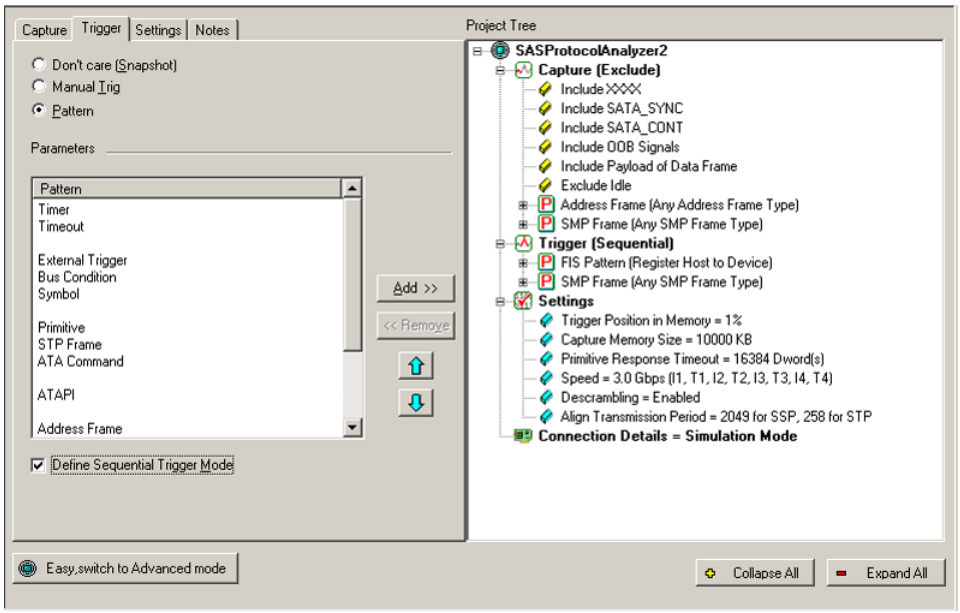


Figure 2.60: SAS: Select Sequential Trigger Mode

SAS vs. SATA: SATA Dialog has different patterns.

Timer

The sequential triggering mode offers the option of triggering on a timer or inserting a timer in the triggering sequence to delay detection of the next pattern in the sequence. To insert a timer in the trigger list, double-click Timer to open the Timer dialog.

Figure 2.61: Timer Dialog

Enter a **Timer Value**, choose the Time Unit, and click **OK**.

Defining Patterns

The definition of patterns for the sequential trigger mode is identical to the Any Trigger mode, with the following exception:

In sequential triggering mode, the definition dialogs for the triggering patterns enable the setting to count the number of occurrences. This allows you to specify the number of times that the pattern must occur before triggering or proceeding in the trigger sequence.

Figure 2.62: Number of Occurrences

Note: The events on each link are counted independently, causing a trigger whenever the number of occurrences on any link equals the specified value.

Triggering Order

As triggering patterns are defined and added, they are displayed in the Project Tree sequentially in the order that they were entered under the Trigger category. When the project runs, the analyzer detects the occurrence of each pattern in order and triggers on the last one.

You can re-order the sequence of triggering patterns. To change the sequence order, highlight a trigger pattern and use the **Up** or **Down** arrow to move it to a new position.

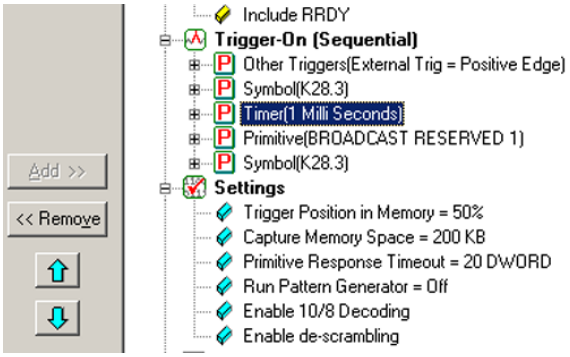


Figure 2.63: Triggering Order

Pre-Trigger

You can set the amount of data to capture before and after the trigger, as a percentage of pre-trigger, between 1% and 99%. Position the pre-trigger slider to a percentage. This feature allows the evaluation of bus activity leading up to and after the triggering event. Figure 2.64 illustrates the operation of pre-trigger in data memory.

Pre-trigger data is capture of the specified percentage of data prior to the triggering event. It cannot be guaranteed and may be 0. This can occur when the triggering event occurs before storing the required amount of pre-trigger event data. In such a case, the data display shows fewer than the specified data points prior to the triggering event.

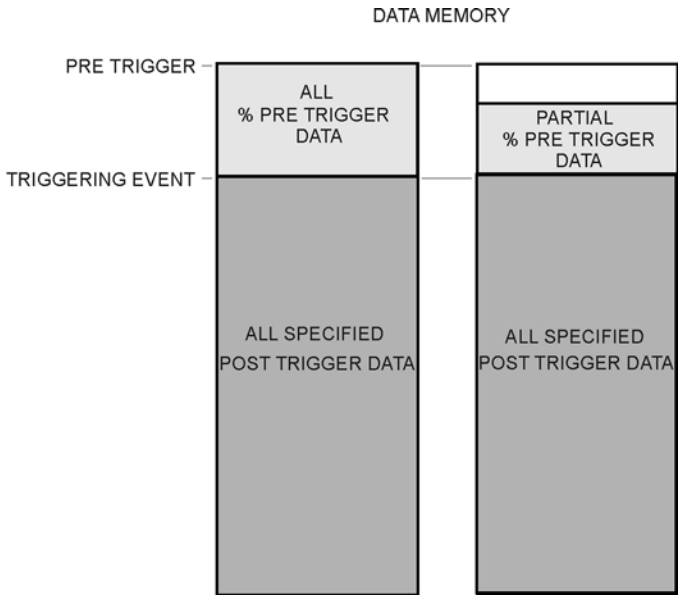


Figure 2.64: Pre-Trigger Example, 20% Pre-Trigger

Project Settings

To set project options, click the **Settings** tab.

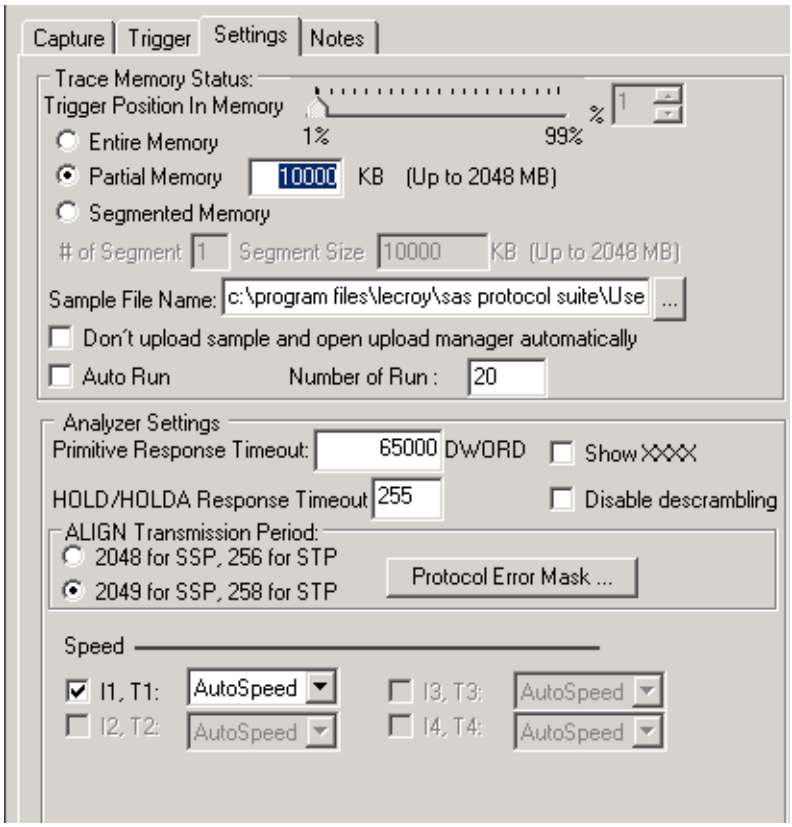


Figure 2.65: SAS: Setting Project Options

SAS vs. SATA: For the ALIGN Transmission Period section, SATA Dialog shows options 256 and 258, and does not show 2048 or 2049.

For Speed, SATA Dialog shows H1, D1 to H2, D2 and does not show I1, T1 to I2, T2. SATA Dialog does not show MUX Setting button.

Memory Settings

The Trace Memory Status section has the following fields.

Trigger Position

Pre-Trigger defaults to 50%, which defines the percentage of data to capture before and after the triggering event. You can change this percentage by dragging the slider.

Capture of the specified percentage of the data prior to the triggering event cannot be guaranteed and may be 0. This can occur if the triggering event occurs before storing the required amount of pre-trigger event data. In such a case, the data display shows fewer than the specified data points prior to the triggering event. For more detail, See “Pre-Trigger” on page 89..

Note: Trigger Position only works when the triggering option is Pattern.

Sample File Name

Click the ellipses next to the Sample File Name text box and choose a file name and location for the results of your current project.

Auto Run

To repeat the current capture and trigger setup automatically, check the Auto Run checkbox and enter the number of times in the Number of Run text box. The capture and trigger repeat automatically for the specified number of times, and the results are saved in consecutively numbered Sample.scs files.

Memory Size

In the Protocol Analyzer Settings tab, you can allot memory for the trace recording. Check **Entire Memory** to allow recording to use the whole memory, to capture the maximum amount of trace data. (Minimum size of memory is 2 GB. Maximum size of memory is 16 GB.)

Partial Memory

To reduce the memory size, check **Partial Memory** and enter a buffer size in kilobytes, up to the memory size in megabytes.

Note: If the size of a data packet exceeds the buffer memory allocation, the project runs, but no data capture occurs. You must increase buffer memory size to a value greater than the packet size.

Segmented Memory

Alternatively, you can use **Segmented Memory**. Enter an integer **# of Segment**, from 1 to 32, then enter an integer **Segment Size** in kilobytes, up to the memory size in megabytes divided by the number of segments. The default segment size is 10 MB.

Each time a trigger condition occurs, the system records a new segment. You can use a Snapshot or Pattern trigger, but not Manual Trigger. As the same trigger automatically repeats, the system makes the number of segments that you entered.

Upload Manager

To upload segments manually in the Upload Manager, select the **Don't upload segments and open upload manager automatically** checkbox.
To upload segments automatically for display as the system creates them, do not select the checkbox.

To view segmented trace files, click the **Upload Manager** button, beside the Record button, to display the Upload Manager dialog.

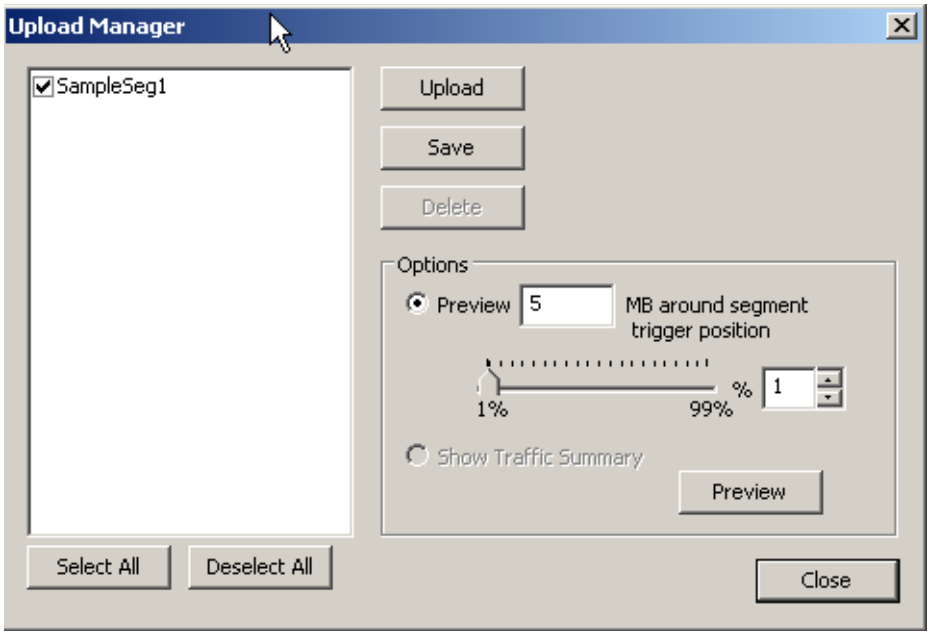


Figure 2.66: Upload Manager Dialog

The dialog displays the segments in the format Segment1, Segment2, and so on.

Select segments by clicking the checkbox. You can also **Select All** or **Deselect All** segments.

You can **Upload** segments for display, **Save** segments as sample files, and **Delete** segments.

The **Preview** radio button allows a preview of an integer number of megabytes around the trigger position. You can set the trigger position as a percentage and select the segment number. Click the radio button to **Show Traffic Summary** with the preview. To show the preview, click the **Preview** button.

Analyzer Settings

Primitive Response Timeout

The Primitive Response Timeout parameter specifies the number of DWORDs between two pair primitives after which the analyzer detects a protocol error. Default value is 65000. When host or device sends a primitive, such as X_RDY, HOLD, or WTRM, it expects device or host to reply with a primitive, such as R_RDY, HOLDA, or R_OK. This parameter detects FIS Signaling Latency error, between HOLD and HOLDA, and FIS State Transition error, between X_RDY and R_RDY, between SOF and EOF, or between WTRM and R_OK or R_ERR.You can set a trigger on these protocol errors.

Disable Scrambling

If checked, causes the Analyzer to assume that no traffic is scrambled. By default, the Analyzer assumes the scrambling state of the devices under test

Show XXXX value

Check this option to display XXXX values.

ALIGN Transmission Period (differs for SAS and SATA)

Choose the ALIGN Transmission Period for SSP and STP by clicking the corresponding option button, then open the Protocol Error Mask dialog.

Protocol Error Mask

Click the Protocol Error Mask button to open the Protocol Error Mask dialog.

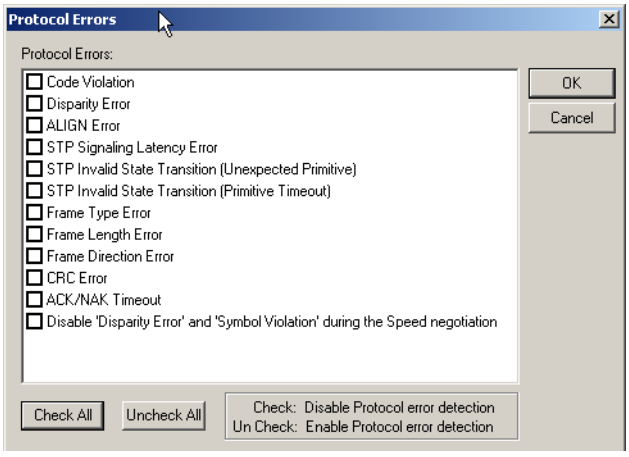


Figure 2.67: Protocol Errors Dialog

Check the Protocol Errors that you want the Analyzer to ignore.

When “RD Error” and “Code violation Error” are set as trigger events:
“RD Error” or “Code violation Error” can occur right after the OOB sequence.
“RD Error” or “Code violation Error” can occur right after the recovery from the PM state.

These errors are mainly caused by the long synchronization time of the analyzer. If these errors, caused by the Analyzer, become triggers, you cannot detect some other errors that you really need to detect. To NOT detect the above two errors, enable the software setting **Disable ‘Disparity Error’ and ‘Symbol Violation’ during Speed negotiation**. After this, the code violation is not triggered during the speed negotiation phase, but is triggered if the violation happens after the speed negotiation phase.

External Trig Out Setting

The Analyzer can send a Low or High external signal anytime a trigger occurs. Select the External Trig Out Setting: High Active, Low Active, or Toggle from High to Low or Low to High once (3.3 V output).

Enter the External TrigOut pulse width.

External Trig In Setting

An external Low or High input signal can cause triggering. Select the
External Trig In Setting: High Active, Low Active, or Toggle from High to Low or Low to High once (3.3 V output).

Choose Port Speed

The default speed is Autospeed. You can also select the port speed from the drop-down list: 1.5 Gbps, 3.0 Gbps, or 6.0 Gbps.

Note: If a Port ID check box has no check, the analyzer does not capture any patterns for that port. The system allocates trace memory for that port to its adjacent port, for example: I1, T1 <-> I2, T2.

Ports Configuration

Select the **Port Configuration** button to display the Set Port Configuration dialog.

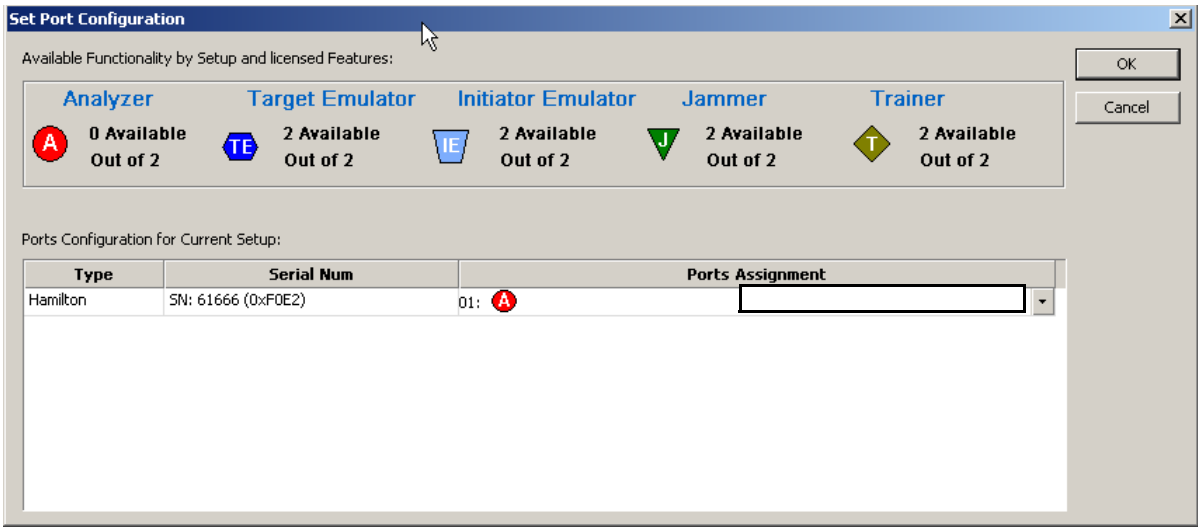


Figure 2.68: SAS: Set Port Configuration Dialog

The dialog shows the current port configuration. To select a port configuration, click the down arrow to display the Select Port Configuration dialog.

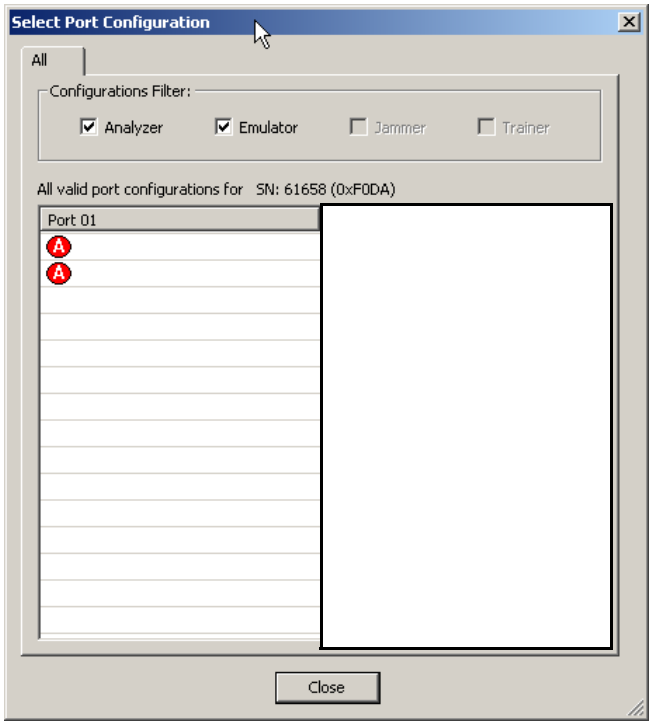


Figure 2.69: SAS: Select Port Configuration Dialog

Port configuration depends on the application you run.

- To act as Analyzer, select the **Analyzer** port configuration.
- To activate the InFusion on a port, select **Jammer**.

Note: To display the current Port Configuration, click the green button in the lower right corner to display the Port Status window (see "Port Status" on page 191).

Port Configuration and Projects

Port Configuration depends on Project selected.

Performance Analyzer and Performance Analyzer with Initiator Emulator do not use ports.

Protocol Analyzer, Protocol Analyzer with Initiator Emulator, and Target Emulator can have the following port configurations.

Project	Number
	One analyzer and/or one emulator
Protocol Analyzer	Port 1.
Protocol Analyzer with Initiator Emulator	Port 1. Pair on Port 1.
Target Emulator	Port 1. Pair on Port 1

Analyzers work with Emulators, Jammer, and Trainer (see below).

One Initiator Emulator can work by itself or work with one Analyzer.

One Target Emulator can work by itself or work with one Analyzer.

Emulators do not work with Trainer.

Emulators work with Jammer (see below).

Jammer can pair with one analyzer on a port.
Jammer does not work with Trainer.

Trainer can pair with one analyzer on a port.
Trainer does not work with emulators.

Trainer does not work with Jammer.

MUX Setting (SAS only)

Enable Muxing on port combinations.

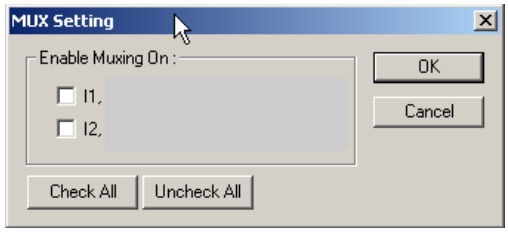


Figure 2.70: MUX Setting Dialog Box

If you enable this option on two ports, the data of both ports transfers on one physical link, whose speed is twice the speed of each link, and the data of two links multiplexes on one physical link. For example, two 3 G ports together make one 6 G port. Note the following:

- The muxing check boxes are usable only if two or more emulator channels are selected.
- The initiator emulator check box is greyed out if only one emulator channel is selected.

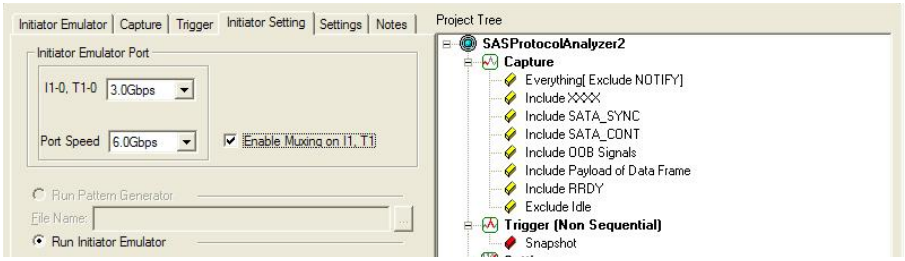


Figure 2.71: Initiator Emulator Check Box and Channel Speeds

- The target emulator check box is not displayed at all until two or more emulator channels are selected.

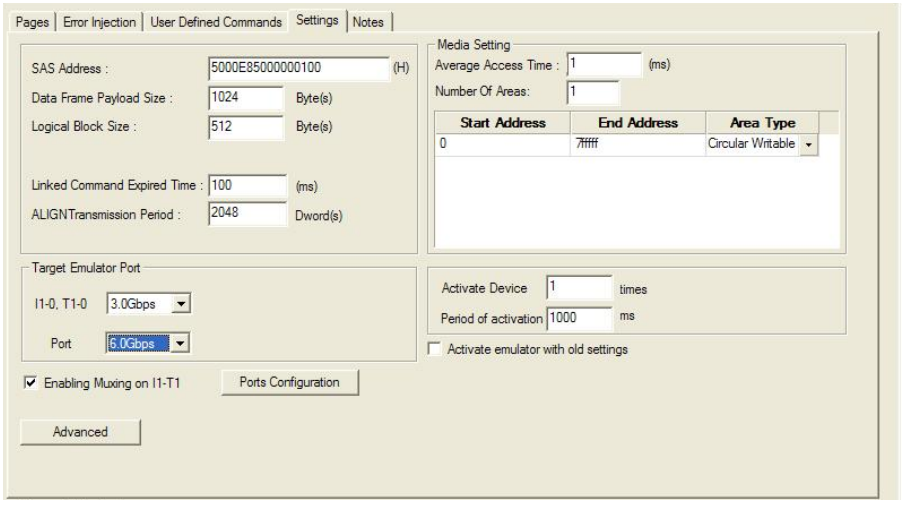


Figure 2.72: Target Emulator Check Box and Channel Speeds

Note: Analyzer must detect MUX primitives from both host and device sides to capture traffic correctly in Muxing mode.

Add a Project Note

To enter and save information about the current project, click the **Notes** tab and enter the data about the project.

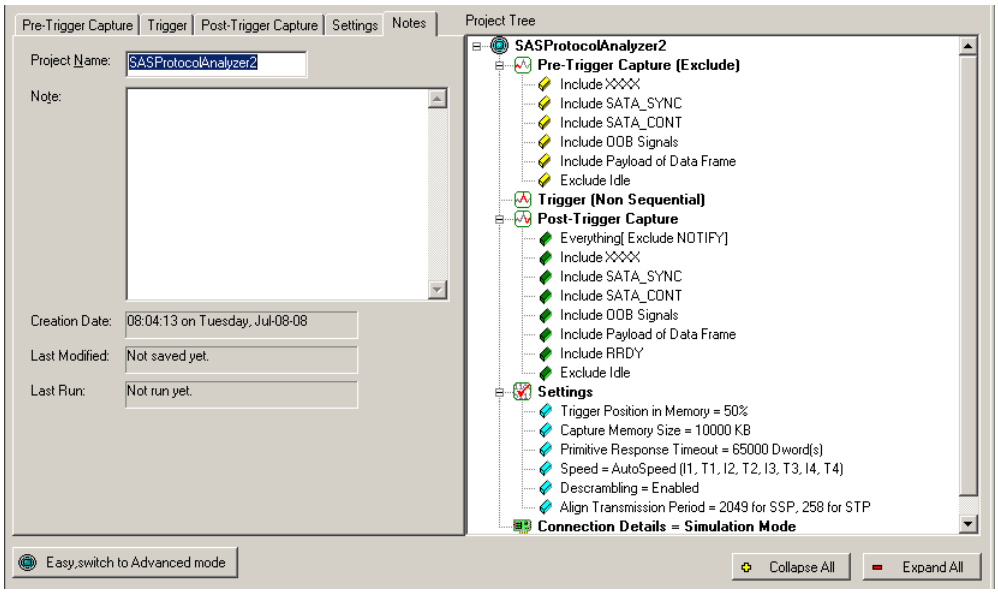


Figure 2.73: Project Notes Tab

Advanced Mode (User-Defined)

Advanced Mode expands Analysis capability by allowing you to program complex triggering and data capture projects.

Note: The Advanced Mode option has to be purchased separately.

The Advanced Mode is a state machine with up to 23 different states. You can program each state individually to:

- Trigger on a different event or trigger unconditionally.
- Capture Everything, Nothing, or a user-defined pattern.
- Include up to three ELSE IF statements, allowing a jump to any other state based on a user definition.
- Use up to three timers, which you can set to a maximum value of 42949 ms. You can set a timer in the state or continue the timer set in the previous state.
- Output an external trigger High or Low.

Note: In Advanced Mode, events on each link are counted independently. A condition is met if the number of events on a link equals the defined occurrence.

Working in Advanced Mode

To start working in the Advanced Mode, click the **Easy, Switch to Advanced Mode** button in an open Analyzer window.

You can:

- Display the state definition
- Set Output Trigger level
- Select up to three timers
- Define the If condition and up to three Else If conditions
- Set number of occurrences before trigger
- Set captured data
- Set excluded data
- Go to next state
- Add state
- Choose link for Sequencer setup

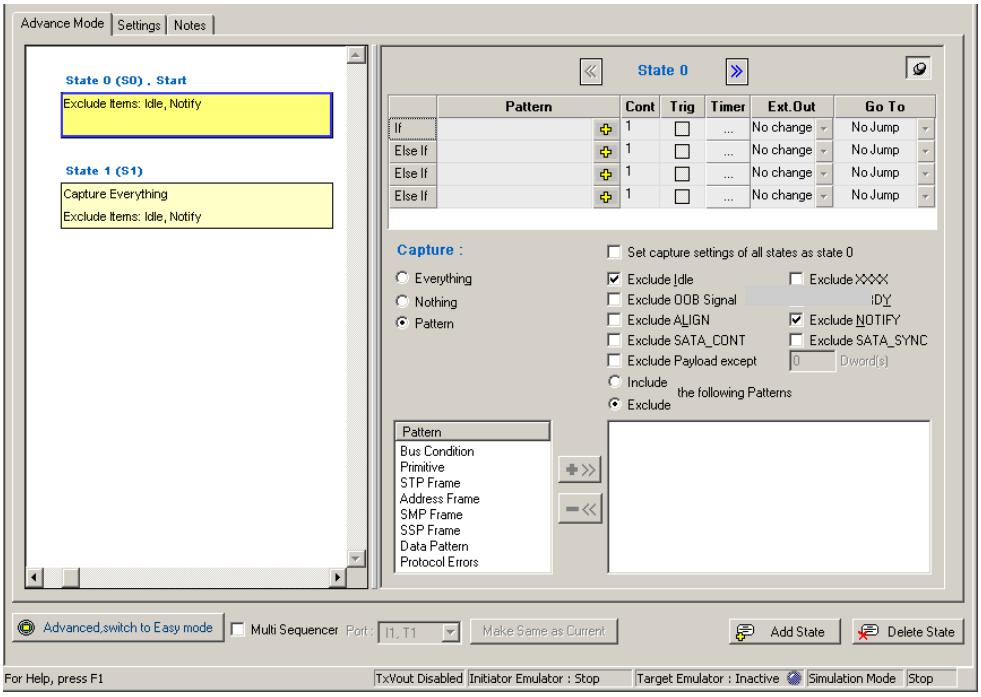


Figure 2.74: SAS: State Programming Dialog

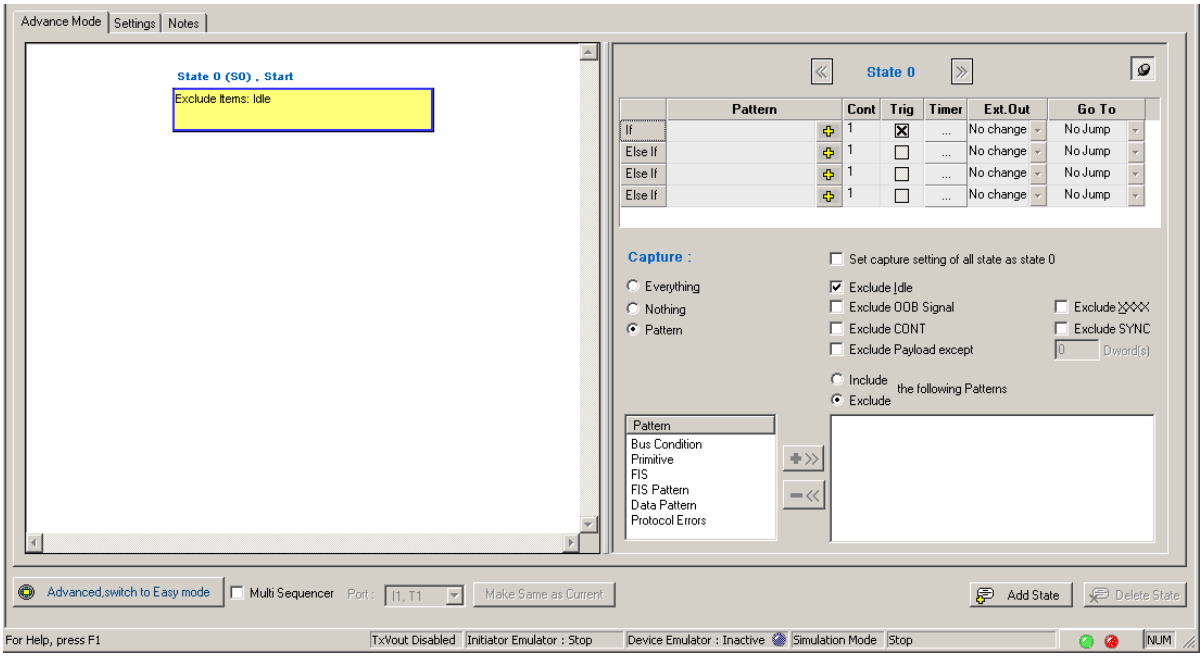


Figure 2.75: SATA: State Programming Dialog

SAS vs. SATA: SATA Dialog removes Exclude ALIGN, Exclude RRDY, and Exclude NOTIFY. SATA Dialog replaces Exclude SATA_CONT with Exclude CONT and Exclude SATA_SYNC with Exclude SYNC.

SATA Dialog has patterns Bus Condition, Primitive, FIS, FIS Pattern, Data Pattern, and Protocol Errors and does not have STP Frame, SMP Frame, STP Frame, or Address Frame.

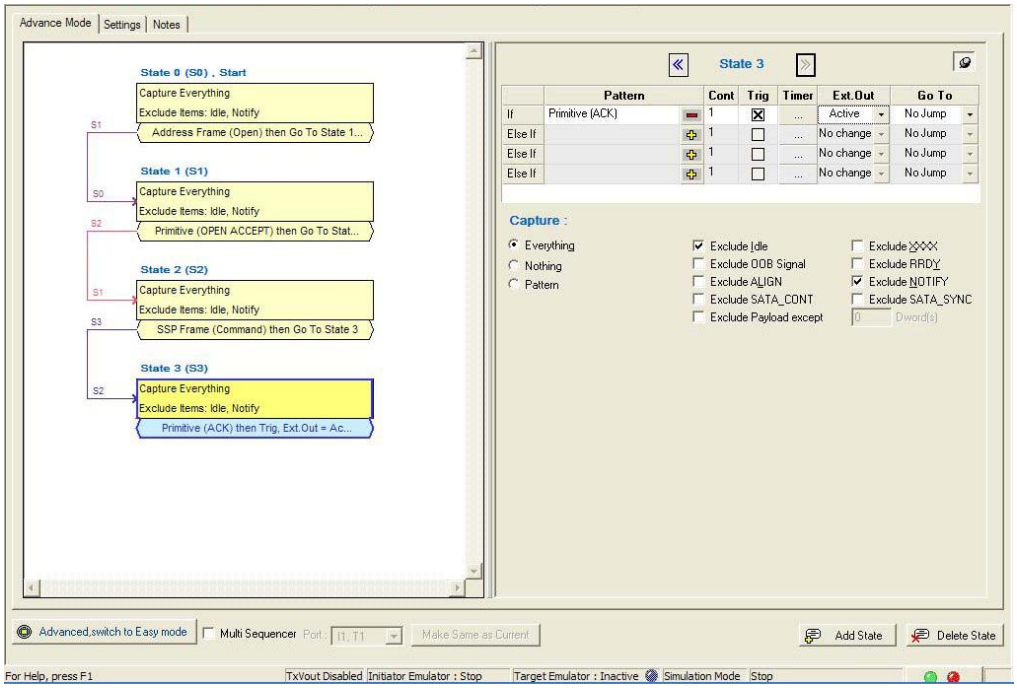


Figure 2.76: SAS: Advanced Trigger with multiple branches

State Number for Complex Trigger Sequences

To follow the path of complex trigger sequences, you can display state number.

To see state number, in Packet View right-click a link layer packet, show field, and select state number.

Setting Trigger Conditions

To set the If and Else If trigger condition:

1. Click the **Add Pattern** button for a Pattern field and choose a trigger condition from the drop-down list.

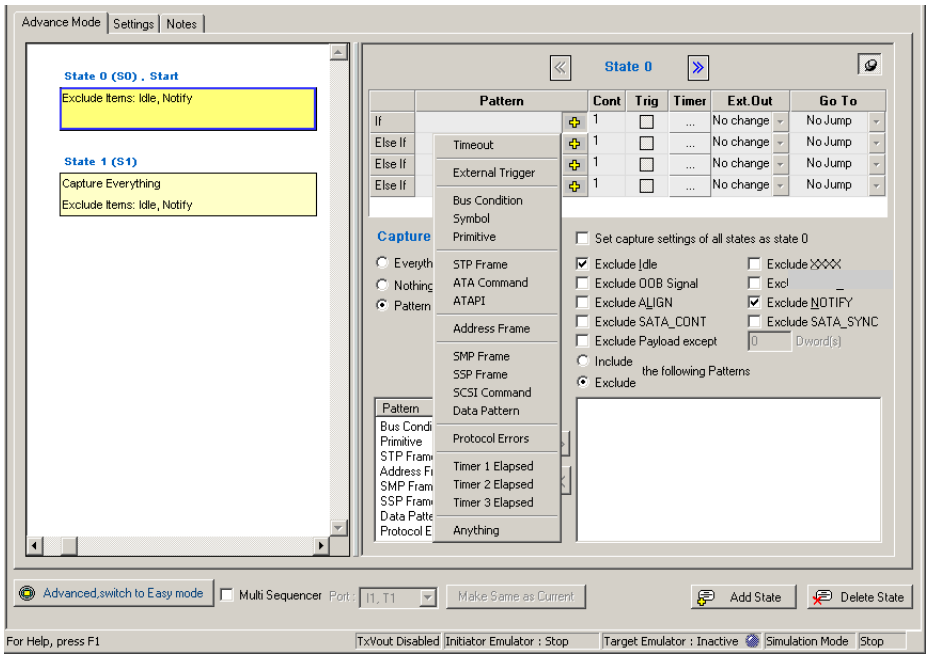


Figure 2.77: SAS: Choosing a Trigger Condition

2. Define each selected pattern in the same way as in Easy Mode, as described starting on page 56. To use a timer, define it first.

Note: You can set a timer for any If or Else If condition.

3. Enter a value for the number of occurrences before trigger in the **Cont** field, up to a maximum of 65535 occurrences.
4. Choose a capture option: **Everything, Nothing,** or **Pattern**.
5. If you choose Pattern, you can select patterns for inclusion or exclusion. Clicking the **Pattern** option enables a pattern definition dialog.

Figure 2.78: SAS: Choosing a Pattern

6. Choose pattern(s) and click the **+>>** button to add them for capture or exclusion. You define each pattern the same way as in Easy mode (see "Defining Patterns" on page 56).
7. For an output trigger, click the down arrow in the **Ext. Out** field and choose an output trigger level. **Note:** Do not use the LOW setting in Advanced Mode.
8. To go to another state, click the down arrow in the **Go To** field and select a state. If no other state has been defined, choose **New State** to add a state.

Set Timers

You can set and use up to three timers for triggering. You can set each timer for each state or continue from a timer set in the previous state. The timer defined for a particular state starts when entering that state. To set timers, click the **ellipses** in the **Timer** field in each state and define each of the timers in the Set Timers dialog.

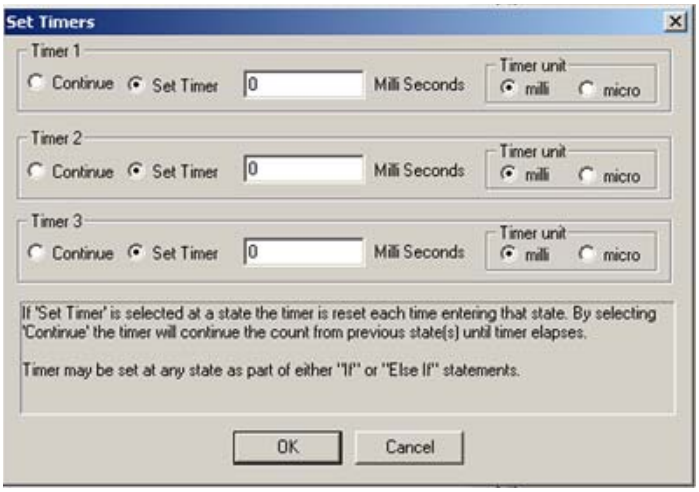


Figure 2.79: Set Timers Dialog

Note: Three timers are available. You have to set and start each timer in order to continue the next timer. For example, you have to start Timer 1, continue it, then set Timer 2 in order to continue it. It will not allow you to continue Timer 2 until you first set it.

Timeout

- You can set a Timeout.
- Select a Pattern for the Start Event. (Start Event resets the timer.)
- Select a Pattern for the End Event.
- Enter the Timeout Value in milliseconds or microseconds.
- Select a Trigger Mode:
  - If End Event occurs before timer expires.
  - If timer expires before End Event occurs.

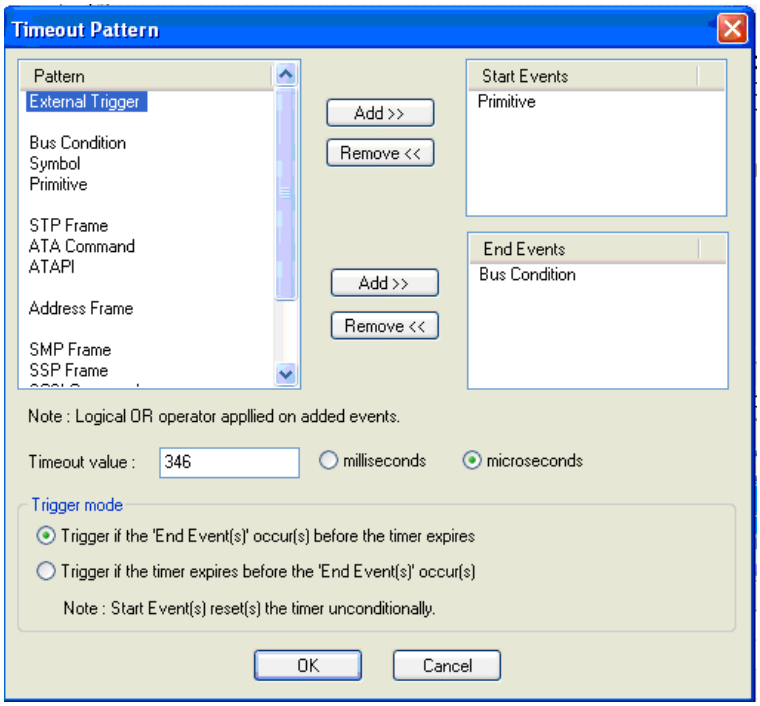


Figure 2.80: Timeout Dialog

WARNING: In Advanced Mode, Short State Jump Intervals Can Cause Hardware Queue Overflow and Corrupt Frames.

When using Advanced Mode, if too many state jumps occur in a short time, the hardware queue can overflow, which may corrupt frames. For example, an infinite loop can cause many state jumps in a short time. Hardware overflow can occur if interval between state jumps is less than 60 DWORDs.

In Advanced Mode, infinite loops are usually used to check if an event occurs before a timeout. In this case, you can use the Timeout dialog to avoid hardware queue overflow.

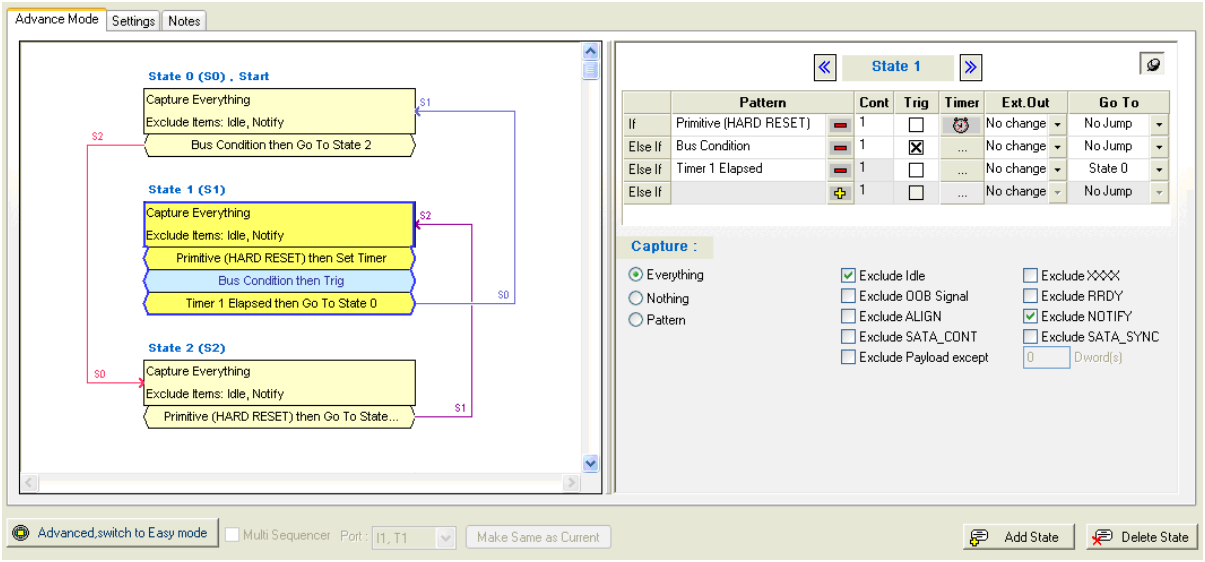


Figure 2.81: State Machine with Multiple Patterns and Timer Elapse

In Figure 2.81: , the port detects HARD_RESET, which starts the Timer. When the timer expires, it jumps to another state. If a trigger occurs between timer start and end, the captured trace will have corrupt frames because of hardware queue overflow.

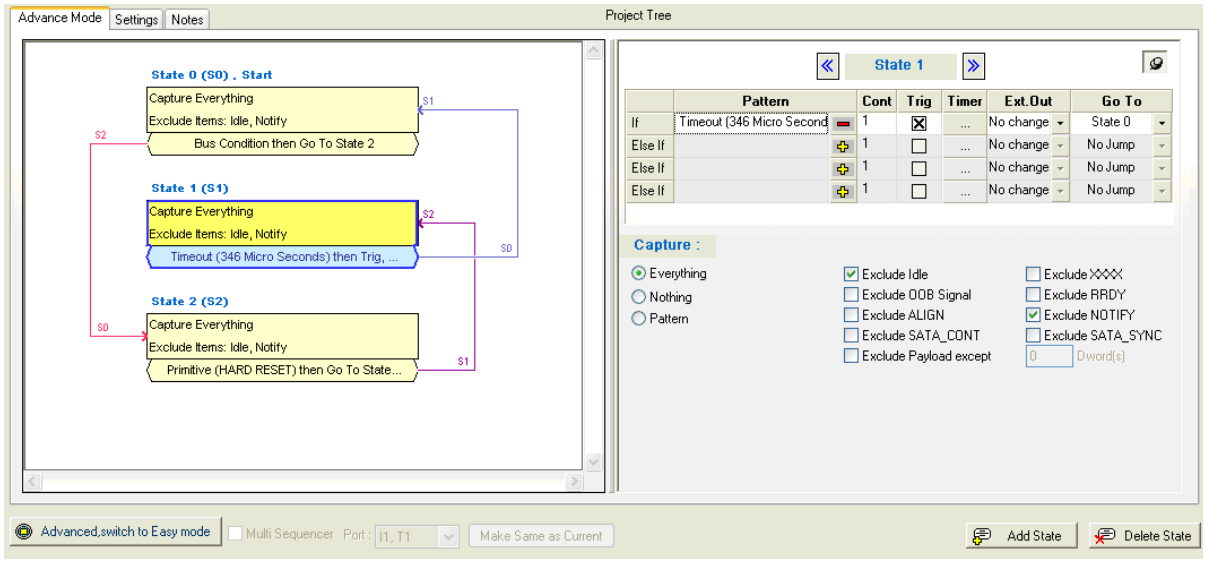


Figure 2.82: State Machine with Timeout Pattern to replace Timer

To overcome this limitation, use a Timeout Pattern instead of Timer. Figure 2.82 shows the state machine using Timeout instead of Timer. Figure 2.83 shows the Timeout settings.

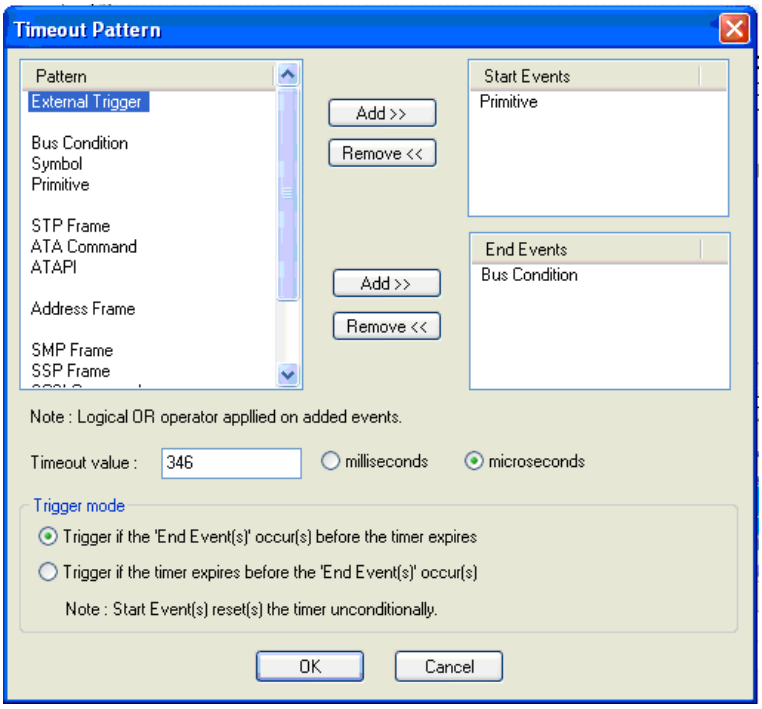


Figure 2.83: Timeout Settings

Timeout begins when the port detects the Start Event. Timer begins when the port detects the Hard RESET primitive. In the Trigger Mode window, set the Trigger to trigger when the port detects the End Event, before the Timeout occurs. In our example, this is the Bus Condition. Capture begins when the ports detects the Bus Condition before the Timeout occurs. If the port does not detect the Bus Condition until the Timeout occurs, the State Machine in Figure 2.82 jumps to State 0.

Useful Key Sequences

The following key sequences are active to assist you in navigating a defined state machine:

Ctrl+a	Add State
Insert	Insert State
Del	Delete State
Ctrl+c/Ctrl+Ins	Copy
Ctrl+v/Shift+Ins	Paste
Up/Down arrow keys	Moves selection between states
Page Up/Page Down	Page Up and Page Down states
Home	Go to first page
End	Go to end page

Project Settings

Prior to running the Advanced mode project, click the **Settings** tab. The options in the Settings dialog are the same as for the Easy Mode, described starting on **page 90**.

SAS vs. SATA: For the ALIGN Transmission Period section, SATA Dialog shows options 256 and 258, and does not show 2048 or 2049.
For Speed, SATA Dialog shows H1, D1 to H2, D2 and does not show I1, T1 to I2, T2.
SATA Dialog does not show MUX Setting button.

Notes

To include some descriptive information about the project, click the **Notes** tab and enter a brief descriptive note (see “Add a Project Note” on page 98).

Creating a Data Block

You can create the following types of data blocks, for use with data fields:

- Random data pattern
- Custom data pattern specifically for your application
- Counter data pattern
- Walking bit pattern

To create a data block, click the **Default Data Block** button on the Main toolbar, or select **Setup > Data Block** to open the Data Block dialog box as shown in Figure 2.84**.**

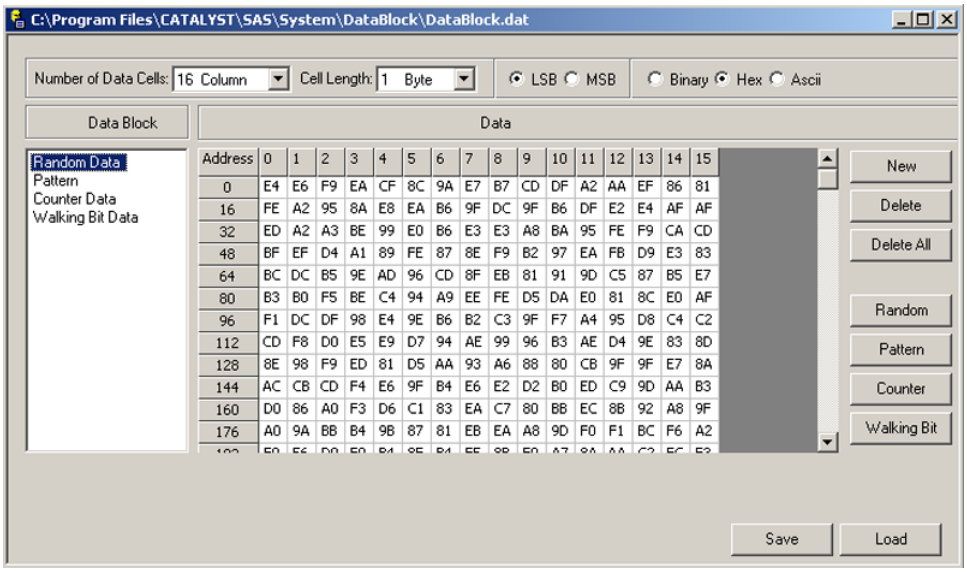

C:\Program Files\CATALYST\SAS\System\DataBlock\DataBlock.dat
Number of Data Cells: 16 Column
Cell Length: 1 Byte
LSB MSB
Binary Hex Ascii
Data Block
Data
Random Data
Pattern
Counter Data
Walking Bit Data
Address 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
0 E4 E6 F9 EA CF 8C 9A E7 B7 CD DF A2 AA EF 86 81
16 FE A2 95 8A E8 EA B6 9F DC 9F B6 DF E2 E4 AF AF
32 ED A2 A3 BE 99 E0 B6 E3 E3 A8 BA 95 FE F9 CA CD
48 BF EF D4 A1 89 FE 87 8E F9 B2 97 EA FB D9 E3 83
64 BC DC B5 9E AD 96 CD 8F EB 81 91 9D C5 87 B5 E7
80 B3 B0 F5 BE C4 94 A9 EE FE D5 DA E0 81 8C E0 AF
96 F1 DC DF 98 E4 9E B6 B2 C3 9F F7 A4 95 D8 C4 C2
112 CD F8 D0 E5 E9 D7 94 AE 99 96 B3 AE D4 9E 83 8D
128 8E 98 F9 ED 81 D5 AA 93 A6 88 80 CB 9F 9F E7 8A
144 AC CB CD F4 E6 9F B4 E6 E2 D2 B0 ED C9 9D AA B3
160 D0 86 A0 F3 D6 C1 83 EA C7 80 BB EC 8B 92 A8 9F
176 A0 9A BB B4 9B 87 81 EB EA A8 9D F0 F1 BC F6 A2
New
Delete
Delete All
Random
Pattern
Counter
Walking Bit
Save
Load

Figure 2.84: Default Data Block Dialog Box

To add another data block:

1. Click the **New** button in the Data Block dialog box.

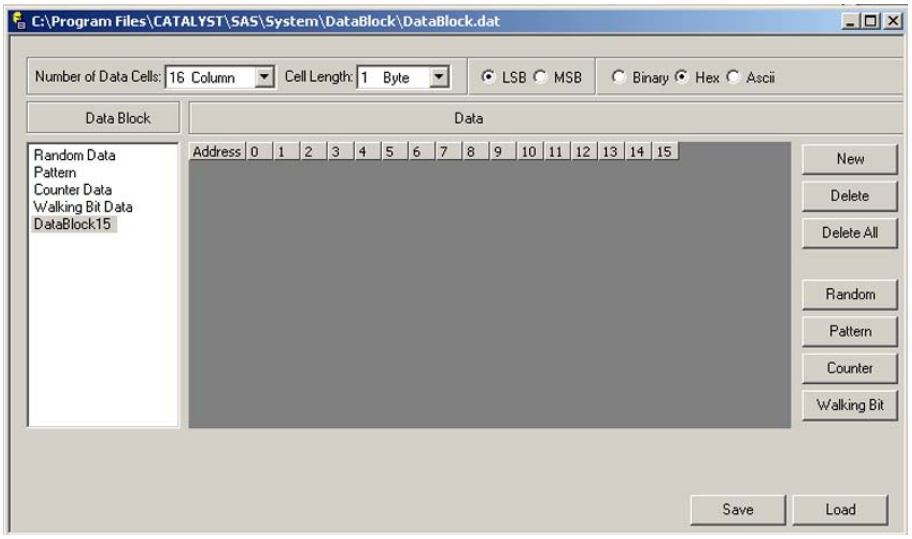


Figure 2.85: New Data Block Dialog Box

2. Choose the number of data columns (up to 16 data cells/row) and the cell length (up to 16 bytes/cell). This is a display function only.
3. Click either the **Bin, Hex**, or **Ascii** option button to choose a number format.
4. Click either the **LSB** or **MSB** option button to choose a bit order.

Naming a Data Block

Each new data block automatically receives a sequential data block number. To assign a unique descriptive name to a data block, right-click the data block name to open the Data Block Edit menu.

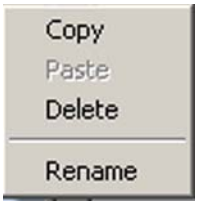


Figure 2.86: Data Block Edit

Choose **Rename.**

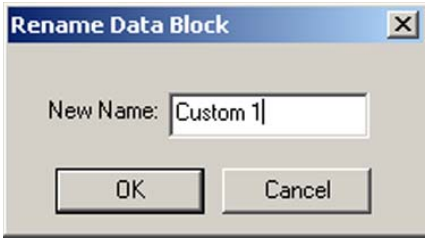


Figure 2.87: Rename Data Block

Enter a descriptive name in the New Name edit box and click **OK.**

Editing a Data Block

You can enter data in the defined cell structure by these methods:

- Define your own pattern
- Set a counter
- Choose a Random Pattern
- Choose a Walking Bit Pattern

Define Your Own Pattern

To define a pattern:

1. Click **Pattern** to open the Define Pattern dialog box as shown in Figure 2.88:
2. Enter a data pattern in the Data Pattern edit box.
3. Choose the number of times to repeat that pattern, and click **OK.**

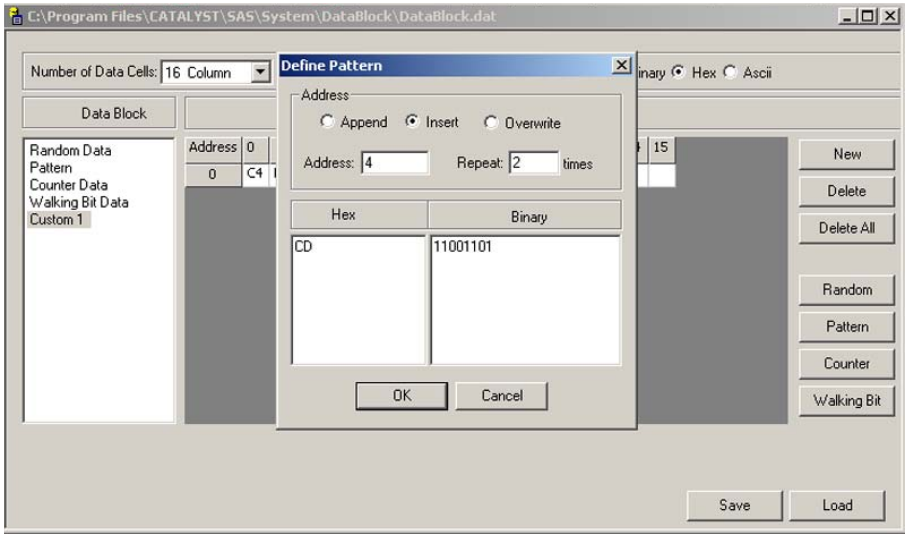


Figure 2.88: Define Your Own Data Pattern

Address

The cell address starts at 0 for the first data entry and automatically increments to the next available address. You can set it to a previously defined address to modify its content or insert additional data.

Insert/Overwrite Data

To define whether to overwrite data in a previously defined cell or insert new data after that cell, toggle the Insert/Overwrite button.

Save

When you have completed a data block definition, click the Save button to save the newly created data block.

Counter

To use a counter as data, click the **Counter** button, enter a Starting Number for the counter and the data address to count to, and click **OK**.

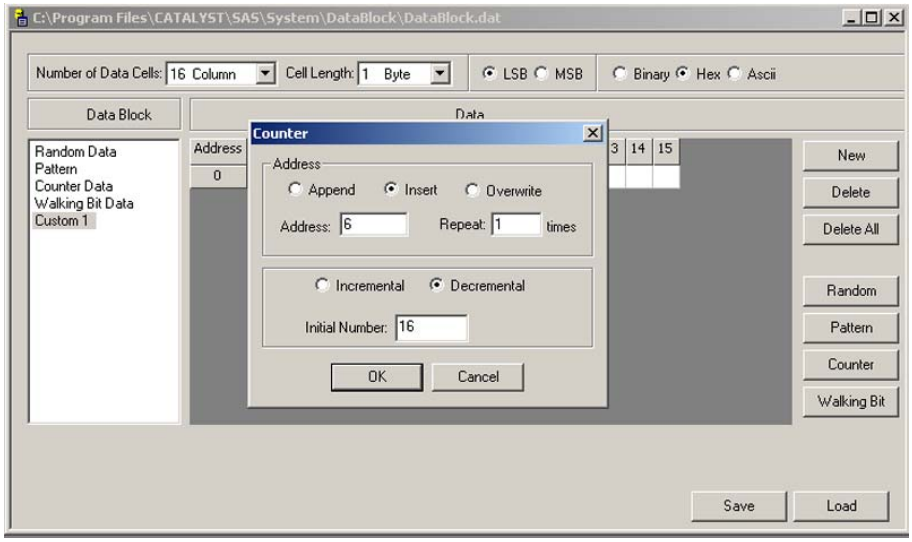


Figure 2.89: Set Counter as Data

Random Data Pattern

To use a random data pattern, click the **Random** button, enter the number of times to repeat the pattern, and click **OK**.

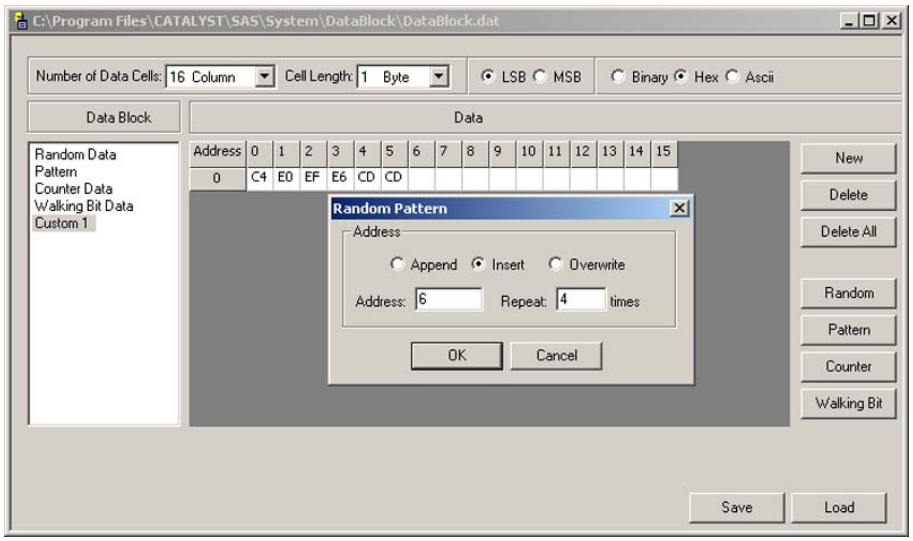


Figure 2.90: Choose a Random Pattern

Walking Bit Pattern

To use a walking bit pattern, click the **Walking Bit** button, then choose either a walking bit of “0” or “1”, the walk direction, the start position, and the number of times to repeat the pattern.

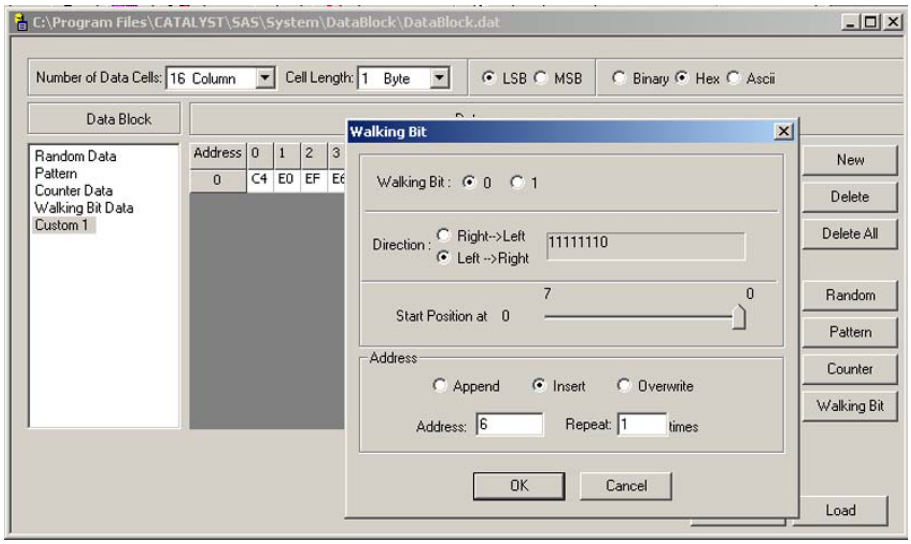


Figure 2.91: Define a Walking Bit Pattern

Creating and Editing Data Blocks as Text

You can create and edit data blocks using a text editor such as Windows® Notepad. To create a data block in Notepad, launch Notepad. Enter a header consisting of [Item1, Item2, Item3, Item4, Item5] where:

Item1 is the name of the Data Block.

Item2 is the size of the Data Block or the number of bytes in the format.

Item3 is the format of the data (HEX, BIN, ASCII).

Item4 is the group of bytes defined (1, 2, 4, 8 or 16).

Item5 is the direction (LSB or MSB).

Then enter the data in space delimited Hex format and save as a *.txt text file.

Load Data

To import Text Editor created data, click the **Load** button in the data block definition dialog to open the Load dialog. Choose a file and click **Load.** Modify existing data.

Save As

To create a new data block from an existing data block using a text editor, select the data block to edit from the **Data Block Name** list, then click **Save As** to open the Save As dialog.

Assign a name to the new data block text file and click **Save**.

You can now edit the newly created text file using Notepad or any other text editor, then import it into the data block definition, as described above.

Chapter 3

Display Manipulation

Viewer Display

After data is captured (Recorded), the Viewer displays a sample file (**.scs** for SAS and **.sts** for SATA) in Packet View.

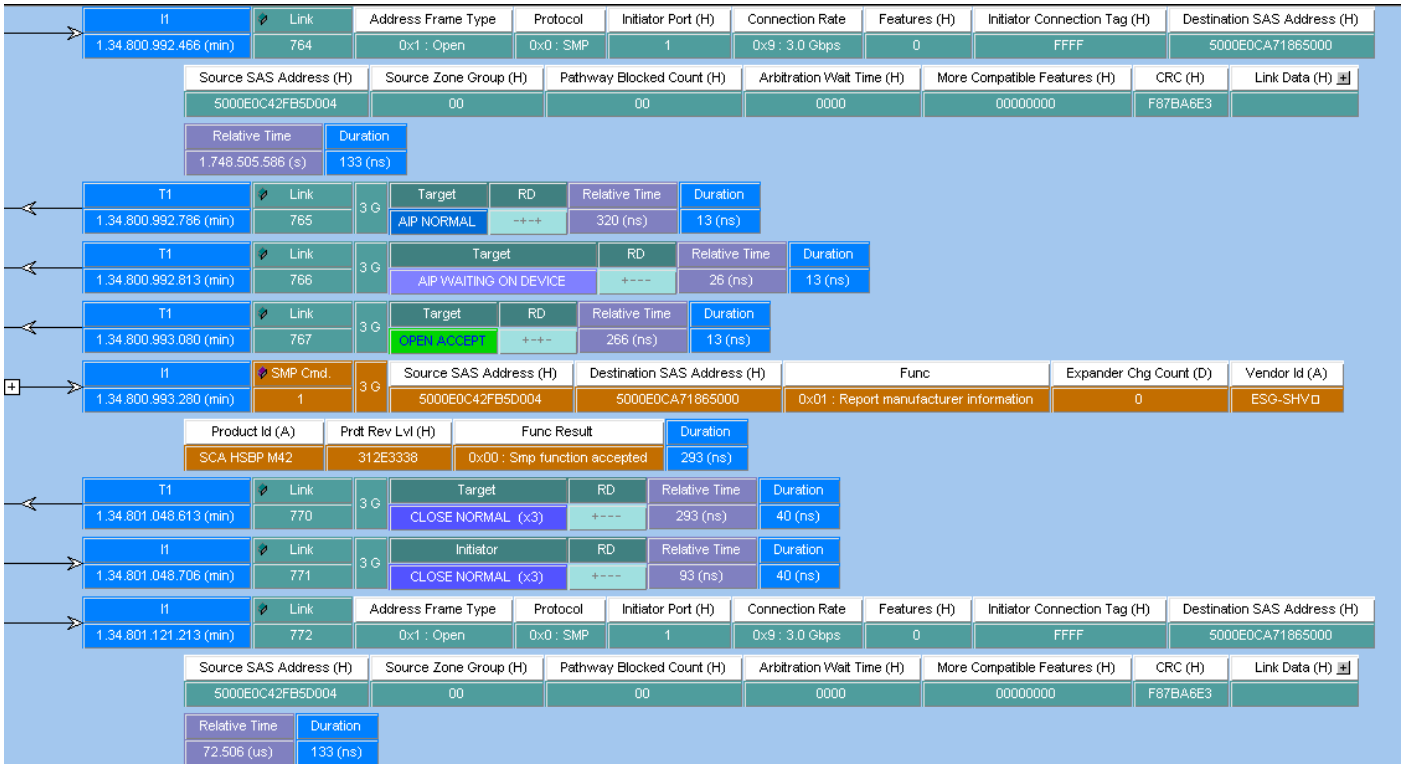


Figure 3.1: SAS: Packet View of .scs Sample File

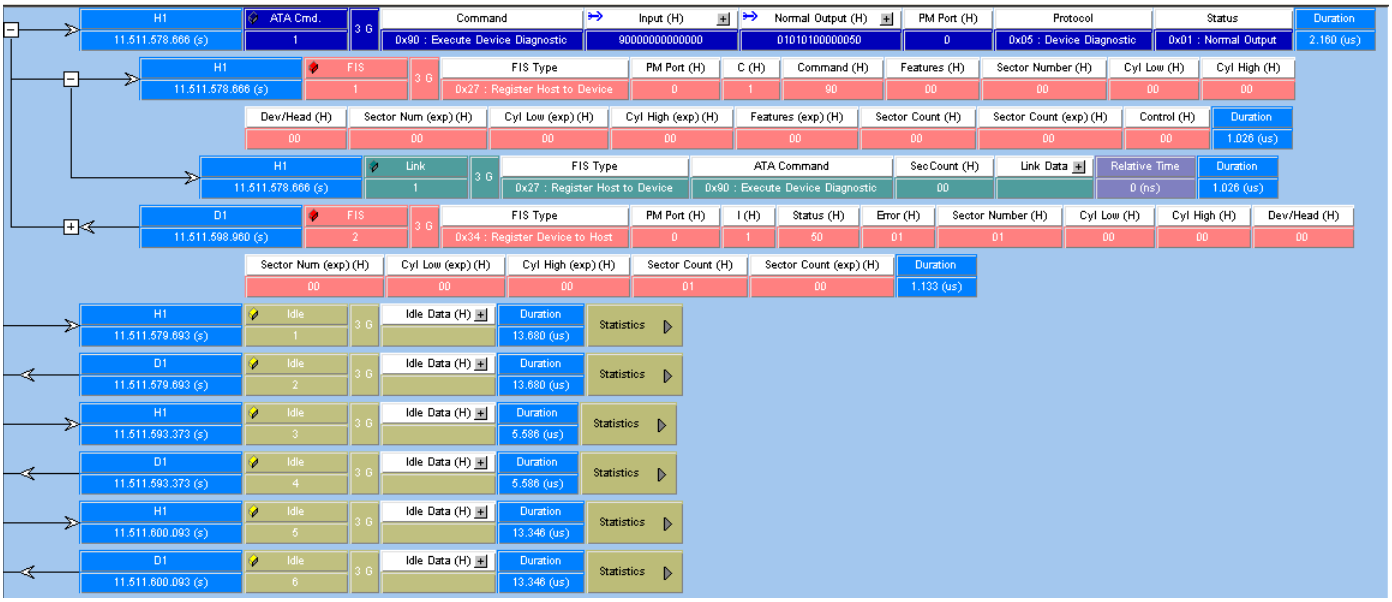


Figure 3.2: SATA: Packet View of .sts Sample File

Quick View

By default, the Software Settings enable **Quick View**. Quick View allows full access to the whole trace more quickly, especially when using a Gigabit Ethernet connection. However, the trace is NOT written to the Host PC hard drive. To save the trace, you must manually click **Save**.

If you uncheck **Quick View** in the Software Settings to disable Quick View, the trace loads more slowly, but is automatically saved to the Host PC hard drive. When Quick View is disabled, the Viewer displays successive parts of trace data as they upload. As soon as a trace part uploads, it is available in all trace views.

If you only need quick successive traces, and do not need to save them, keep the default setting to enable Quick View.

If you need to save all captured traces, unchecking the Quick View setting loads traces faster, especially for larger traces and slower connections than Gigabit Ethernet.

To refresh the viewer display with more uploaded data, scroll to the end of the trace, using scroll bars, page down, arrow down, or CTRL-End. Newly uploaded data then appears there.

Note: High-level decoding and statistics are available only after the whole trace has uploaded.

The software automatically switches to full trace view after trace uploading finishes.

Note: Users must press **CTRL Home** to go to the beginning of an uploaded trace, and **CTRL End** to go to the end of an uploaded trace.

Using the Viewer Display

To configure the data viewer display, use the toolbars. You can display the same data in:

- Packet view
- Spreadsheet view
- Column view, with transactions grouped for each active port
- Text view, with transactions grouped for each active port
- Waveform view
- Field List view
- Histogram view
- Bus Utilization view
- Data Report
- Statistical Report view

To change the view type when opening a sample, change the default workspace or save options in the Software Settings dialog.

To toggle among open windows, use **CTRL - TAB**.
To reverse toggle order, use **CTRL - SHIFT - TAB**.

To make a frame a trigger pattern, in Packet View, right-click any frame, select **Add to Trigger**, and add the pattern to **DataPatternCapture**.

Viewer Display enables you to also perform the following:

- Decode Assignments (Refer to “Decoding Assignments” on page 118 for more details.)
- Compare Two Data Payloads (Refer to “Compare Two Data Payloads” on page 158 for more details.)
- Run Verification Scripts (Refer to “Running Verification Script Engine (VSE)” on page 159 for more details.)

Trace Properties

The Trace Properties dialog displays:

- Software version
- Sample file version
- Grouping Type
- Hardware bin file version
- Analyzer armed at
- Analyzer triggered at
- Sample saved at
- Original Capture Project: **Open** displays the project settings used to capture the sample.
- Licensing Information

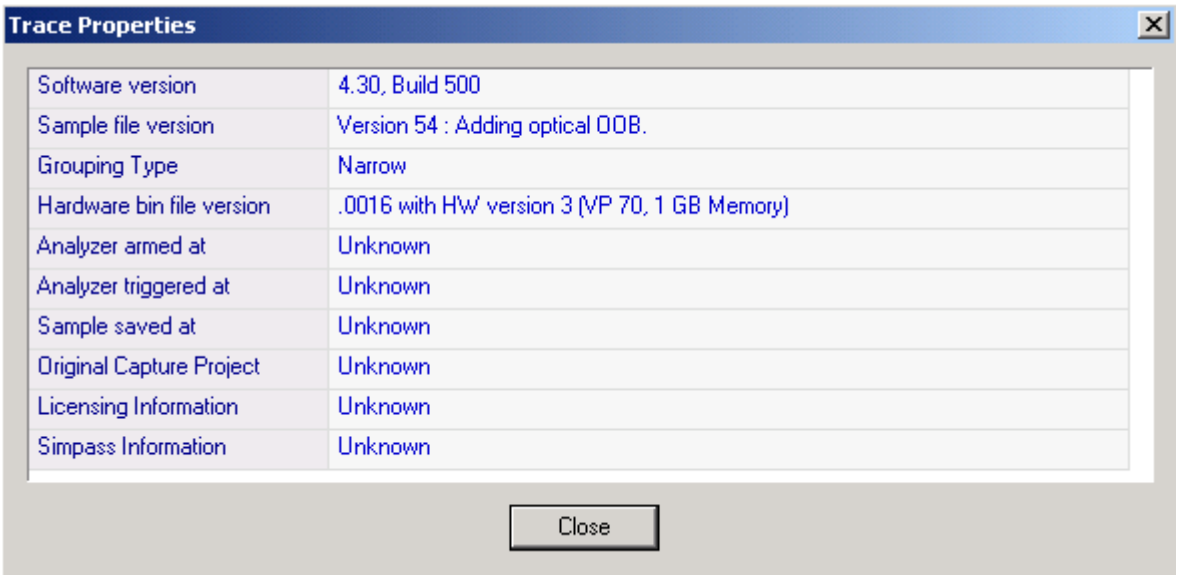


Figure 3.3: Trace Properties Dialog

Analysis

The Analysis menu options allows you to see the trace in various views and switch views.

Show Analysis Toolbar

To display the capture in any of the other available views you can make the selection on the View Type toolbar as shown below or select the menu option under Analysis as shown in Figure 3.5 on page 117.

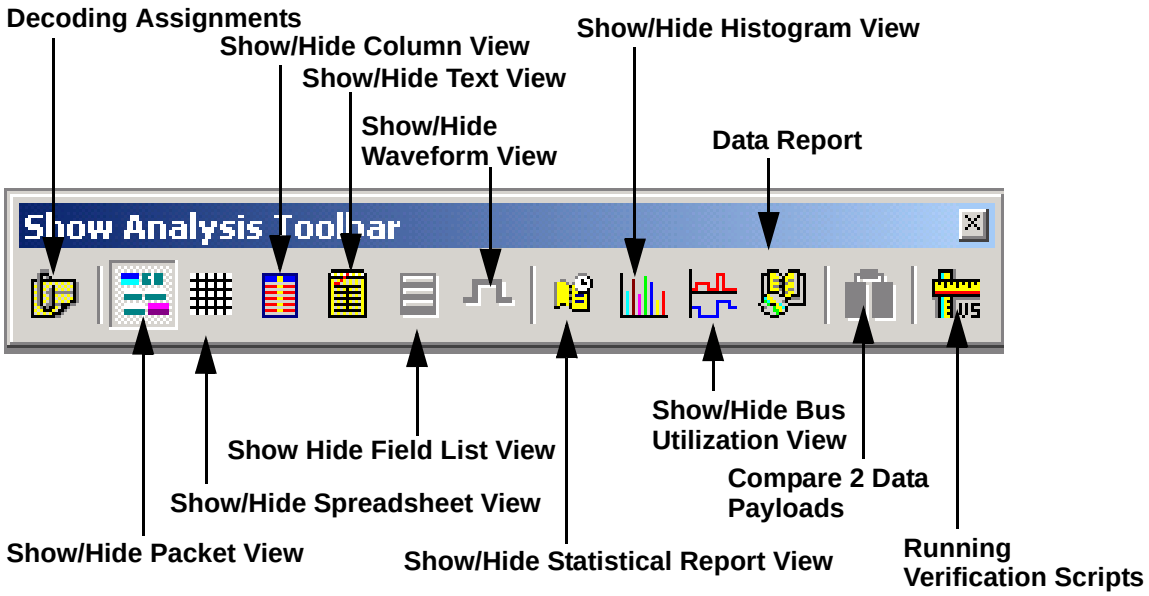


Figure 3.4: View Type Toolbar

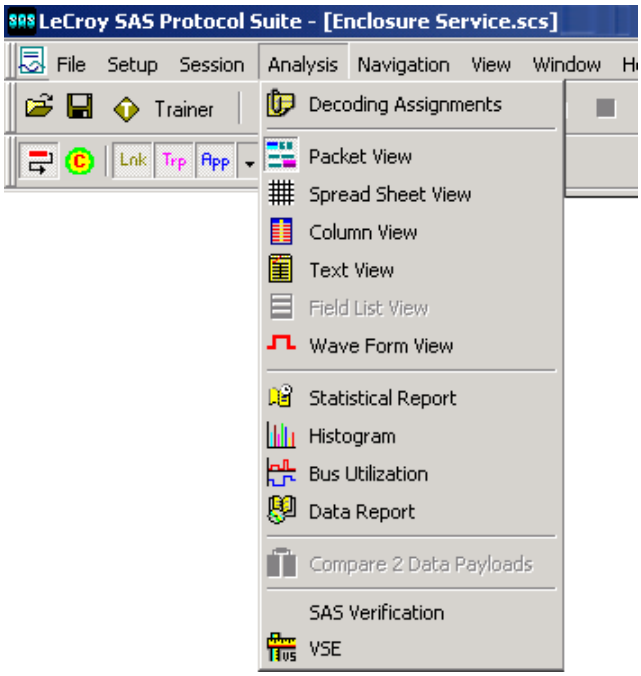


Figure 3.5: SAS Analysis Menu

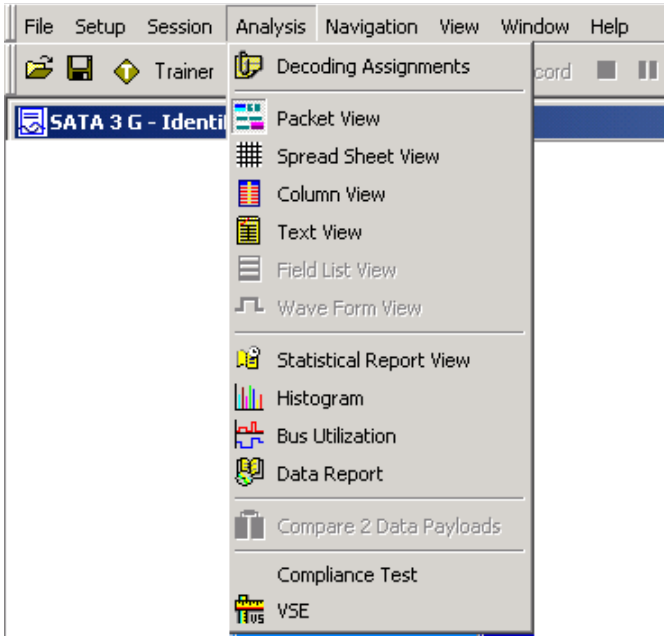


Figure 3.6: SATA Analysis Menu

Decoding Assignments

Click on the Decoding Assignments icon to display the Decoding Assignment dialog. Check a **Hash Destination SAS Address** checkbox to select it and select a **SCSI Spec(s)**. Click the **Add to Assigned List** button to decode. Select a spec and click **Remove it** or click on **Remove All** to remove all the specs.

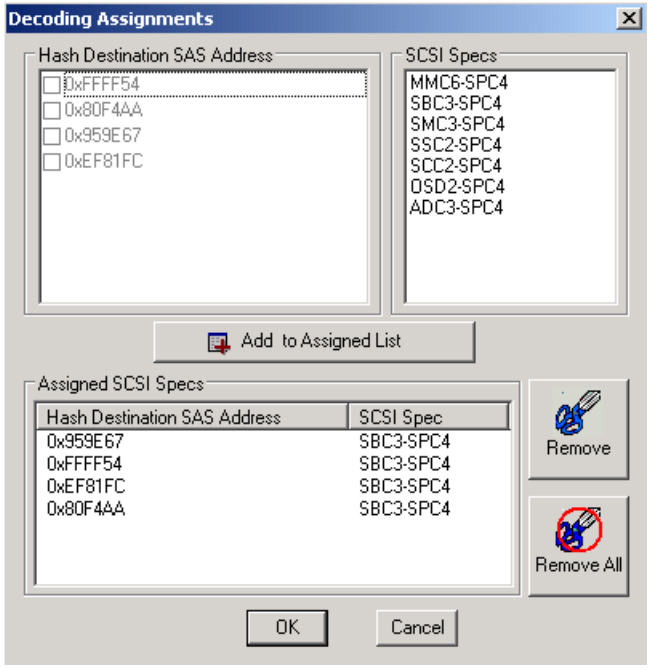


Figure 3.7: Decoding Assignments Dialog for SAS

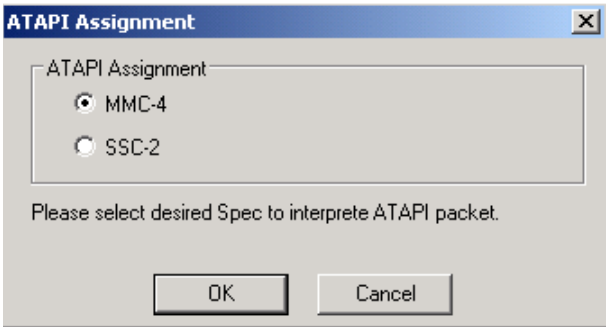


Figure 3.8: ATAPI Assignment Dialog for SATA

Packet View

After you select a view, it appears in a separate window. To increase the new window display size, select **View > Packet View** or click the **Show/Hide Packet View** button to hide the Packet View.

When scrolling through a window display using the scroll bar, the displays in the other windows also scroll.

To rearrange the tiling, select the **Window** menu and choose **Cascade, Tile Vertical,** or **Tile Horizontal**.

Packet View Metrics

The Metrics feature provides quick access to additional information about the packet data. Click the Metrics + icon as shown in Figure 3.9 to display the details.

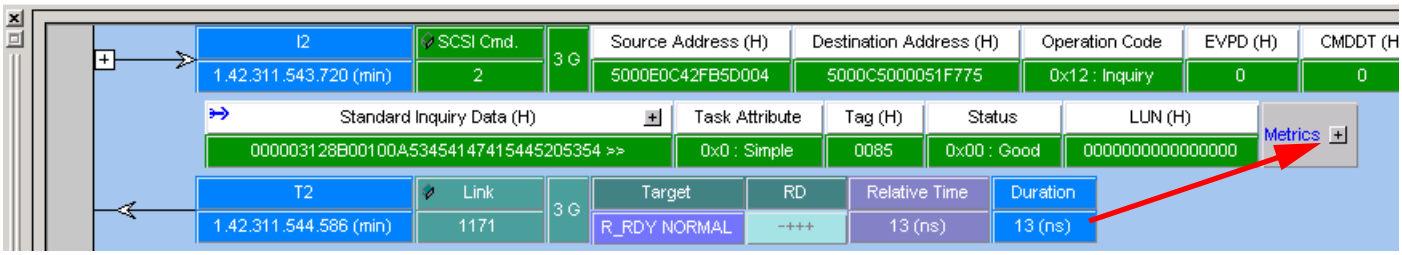


Figure 3.9: Packet View Metrics

The following additional information of the packet is displayed when the Metrics field is expanded. Refer to Figure 3.10 on page 120.

Trp. No. - Number of Transports

The total number of transports that compose this exchange.

Resp. Time - Response Time

The time taken to transmit this command on the link(s) from the begining of the first frame in the command to the end of the last frame in the command.

Pld. Bytes - Payload Bytes

The number of payload bytes this operation transferred.

Latency Time

The time measured from the transmission of the command to the first data transmitted for this IO operation.

Data-Stat. Time - Data to Status Time

The time between the end of data transmission for this command and the Status frame.

Thrpt MB/s- Data Throughput

The payload divided by response time expressed in MB per second.

Duration

The time taken from the first DWord to the last DWord in a line.

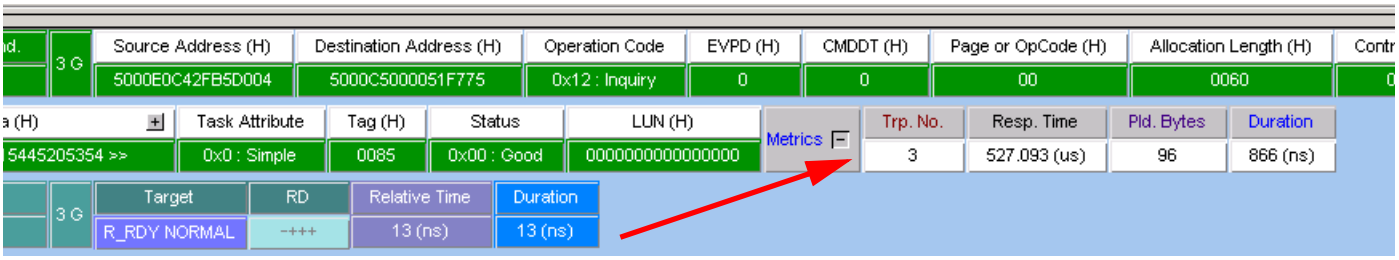


Figure 3.10: Packet View Metrics Expanded

Changing the Default View

Perform the following steps to change the default view of all trace files to Packet View:

1. Open a trace file.
2. Select the **Packet View**. Close all other views.
3. Select **File > Save Workspace** to open a Save As dialog. Save the current workspace as a **.wss** file.
4. Select **Setup > Preferences > Software Settings** to open the Software Settings dialog.
5. In the Default Workspace field, enter the path and name of the workspace **.wss** file that you saved in step 3.

Because the default workspace contains only Packet View, the software opens trace files in Packet View.

Spreadsheet View

Spreadsheet View displays all of the Packet View fields in a time sequential spreadsheet format. To display the Spreadsheet View of the current capture, click

Analysis > Spreadsheet View or click the button on the View Type toolbar.

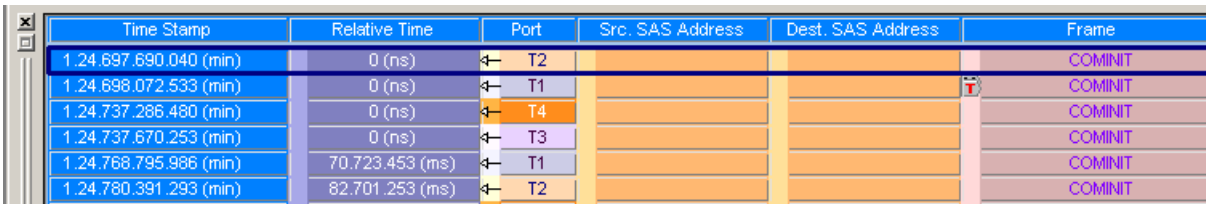


Figure 3.11: SAS: Spreadsheet View

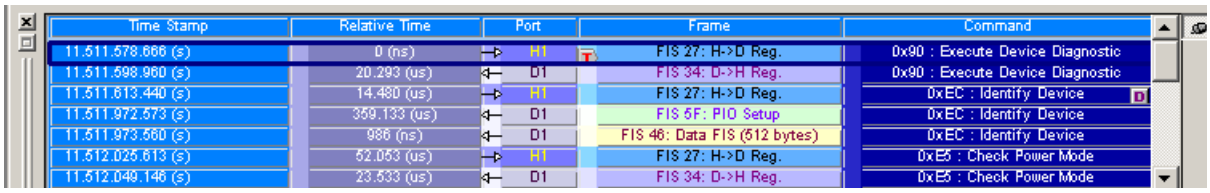


Figure 3.12: SATA: Spreadsheet View

Right-click a column heading to go to **Software Settings**, make all columns the same width, choose **Time Stamp Format**, or **Goto** a position.

Right-click a column heading to **Hide** or **Show** the column. To show the same columns permanently, select **Setup> Preferences>Software Settings> Sample Viewer > As Previous Saved**.

Right-click the column to **Add Bookmark** or **Edit Bookmark**, **Set Time Stamp Origin**, go to **Software Settings**, choose **Time Stamp Format**, **Change Background (or Foreground) Color**, or **Goto** a position.

Note: You can double-click a data frame to display the data payload view.
The Status column can show ABRT and UNC status.

Save As Text/Excel

Select **File > Save As Text/Excel** to open the Save As Text dialog.

For Save As Type, select **Text Files** or **Excel Files**.

For Save As Range, select **All Packets** or enter a cursor range.

Enter a **File Name** and click **Save**.

Note: The Save As Excel option is available only for Column View and Spreadsheet View.

Change Format of Logical Block Address (LBA)

You can set different LBA formats in Packet View and Spreadsheet View. To change the LBA format, right-click the LBA column to display the popup menu, select **Format,** and change the format to **Decimal, Hexadecimal,** or **Binary**.

In Spreadsheet View, you can also click the **Trace Viewer Configuration** icon to display the Trace Viewer Configuration dialog. Expand the **Frame List/Spread Sheet View**, select **LBA/Sector#**, and change the **Format**. If you cannot change the format there, select the **Link Fields, Transport Fields, ATA Cmd. Fields**, or **SCSI Cmd. Fields** node, select the field (such as “LBA High”), and then change the **Format**.

Column View

Column View displays the captured data grouped in columns by port. Each row shows captured DWORDs on different ports related to the timestamp. It also shows different speed (1.5G, 3G, 6G) DWORDs. Different DWORD cell height shows the duration of the DWORD. To display Column View of the current capture, click **Analysis > Column View** or click the button on the View Type toolbar.

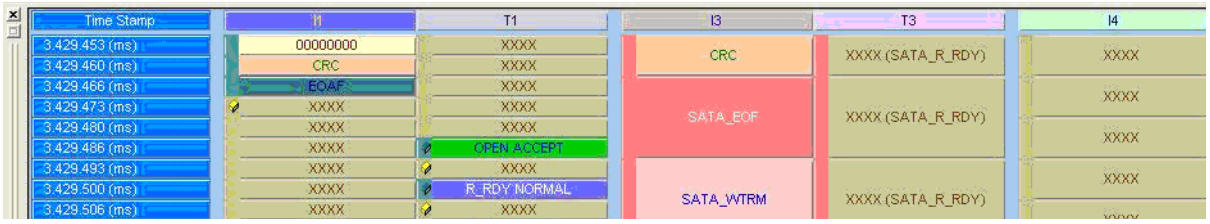


Figure 3.13: SAS: Column View

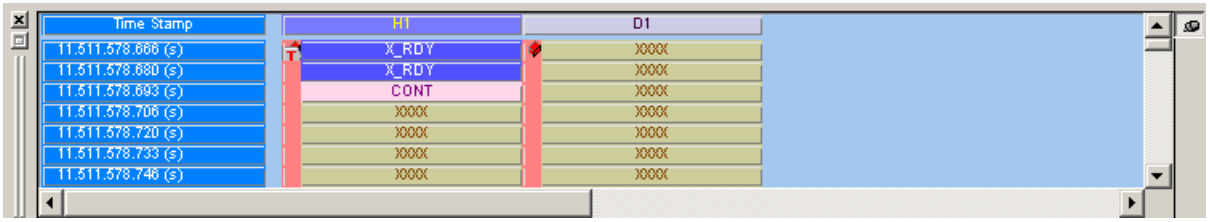


Figure 3.14: SATA: Column View

Right-click in the Column View to display commands:

- Software Settings
- Time Stamp Format (LeCroy Format, Milli Second, Micro Second)
- Go to (Trigger Position, X Position, Y Position, Packet Number, Time Stamp, Bookmark, Begin, End)
- Bookmark
- Goto within Packet (SOF, EOF, Next HOLD, Previous HOLD, Next HOLDA, Previous HOLDA, Next Align, Previous Align, Next R_IP, Previous R_IP)

Note: The Column View displays the CRC value. To see different formats (10b, 8b, scrambled, and so on), select a format by clicking its Tool menu button.

Resize Columns

You can resize the columns in Column View by clicking in the column boundary and dragging the boundary to a new position.

Rearrange Columns

You can rearrange columns by left-clicking in the column title and then dragging the drag-and-drop icon to a new position.

Save As Text/Excel

Select **File > Save As Text/Excel** to open the Save As Text dialog.

For Save As Type, select **Text Files** or **Excel Files**.

For Save As Range, select **All Packets** or enter a cursor range.

Enter a **File Name** and click **Save**.

Note: The Save As Excel option is available only for Column View and Spreadsheet View.

Text View

Text View displays the captured data interpreted as transaction frames, grouped in columns by port.

To display Text View, select **Analysis > Text View** or click the button on the View Type toolbar.

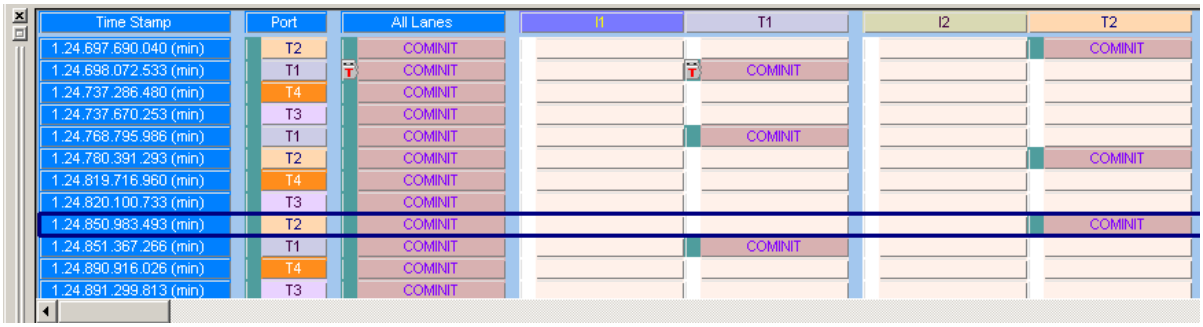


Figure 3.15: SAS: Text View

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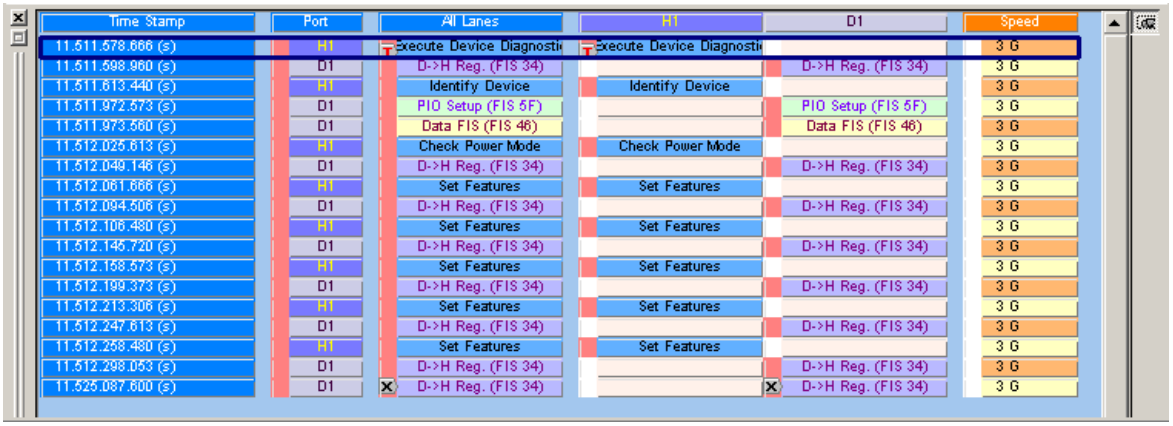

Time Stamp
Port
All Lanes
H1
D1
Speed
11.511.678.666 (s) H1 Execute Device Diagnosti Execute Device Diagnosti 3 G
11.511.698.960 (s) D1 D->H Reg. (FIS 34) D->H Reg. (FIS 34) 3 G
11.511.813.440 (s) H1 Identify Device Identify Device 3 G
11.511.972.573 (s) D1 PIO Setup (FIS 5F) PIO Setup (FIS 5F) 3 G
11.511.973.560 (s) D1 Data FIS (FIS 46) Data FIS (FIS 46) 3 G
11.512.025.613 (s) H1 Check Power Mode Check Power Mode 3 G
11.512.049.146 (s) D1 D->H Reg. (FIS 34) D->H Reg. (FIS 34) 3 G
11.512.061.666 (s) H1 Set Features Set Features 3 G
11.512.094.506 (s) D1 D->H Reg. (FIS 34) D->H Reg. (FIS 34) 3 G
11.512.106.480 (s) H1 Set Features Set Features 3 G
11.512.146.720 (s) D1 D->H Reg. (FIS 34) D->H Reg. (FIS 34) 3 G
11.512.158.573 (s) H1 Set Features Set Features 3 G
11.512.199.373 (s) D1 D->H Reg. (FIS 34) D->H Reg. (FIS 34) 3 G
11.512.213.306 (s) H1 Set Features Set Features 3 G
11.512.247.613 (s) D1 D->H Reg. (FIS 34) D->H Reg. (FIS 34) 3 G
11.512.258.480 (s) H1 Set Features Set Features 3 G
11.512.298.053 (s) D1 D->H Reg. (FIS 34) D->H Reg. (FIS 34) 3 G
11.525.087.600 (s) D1 D->H Reg. (FIS 34) D->H Reg. (FIS 34) 3 G

Figure 3.16: SATA: Text View

Note: The LBA and Tag Number value are shown in the All Lanes column.

Field List View

Whenever an additional view (such as Text View) displays, you can display a Field List View, which displays field information in a list format. The information of this view is shown in the Packet View under the Transport layer. Expand the Info Unit, then expand the Sense Data, refer to the screen capture below.

To open a Field List View of the current capture, select **Analysis > Field List View** or click the button on the View Type toolbar.

Note: This icon will appear in the top tool bar only if the spreadsheet view is displayed.

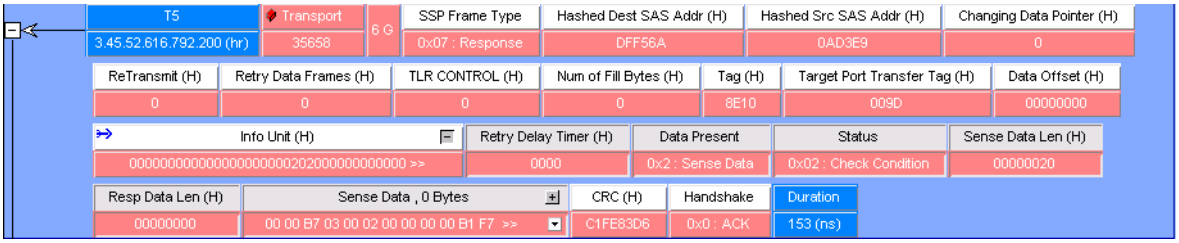


Figure 3.17: Packet Decode Information

Field List View Displayed in a Separate Window

Click **Setup > Software Settings** and select the **Field List View** tab, refer to Figure 3.130 on page 208 to see the default settings of the Field List View dialog. The **Show Field List in Column View** checkbox is selected as the default setting. In order to view the Field List View in a separate window the Spreadsheet View needs to be open.

Click on the Field List View icon to view it in a separate window as shown in the following figure.

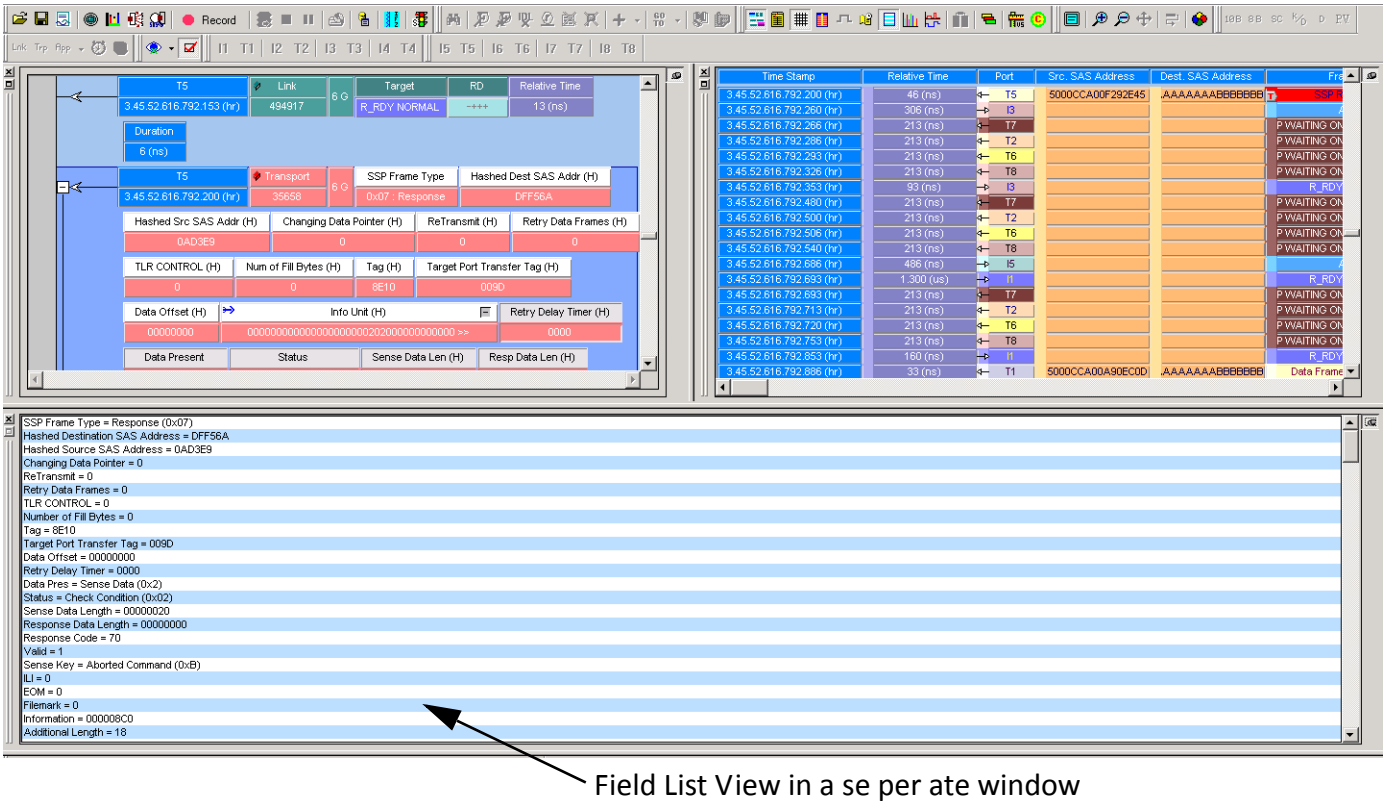


Figure 3.18: Field List View Displayed in a Separate Window

Field List View Embedded in Frame or Spreadsheet Views

Click **Setup > Software Settings** and select the **Field List View** tab, refer to Figure 3.135 on page 214 to see the default settings of the Field List View dialog. The **Show Field List in Column View** checkbox is selected as the default setting. Select the **Show Field List as Embedded in frame/spreadsheet views** checkbox in order to view the Field List View embedded in the Frame or Spreadsheet View.

Refresh the spreadsheet view to see the Field List View embedded as a column as shown in the following screen capture.

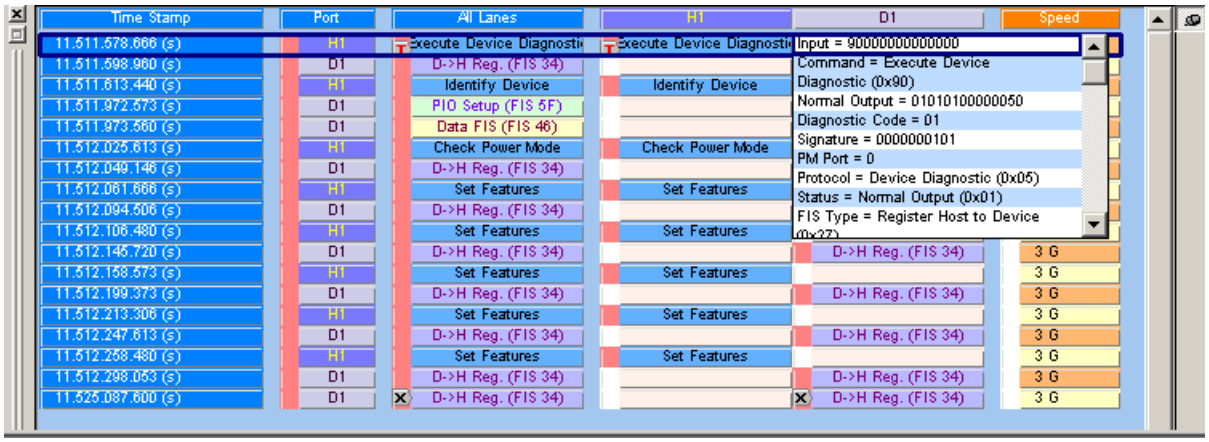


Figure 3.19: Field List View

In the Column View, check the S**how Field View in Column View** checkbox in the **Software Settings** dialog under the **Setup> Preferences>** file menu, then display Field View while the Column View is open.

Waveform Display

You can enable a waveform display for all active ports, and perform timing measurements, by positioning timing cursors within the waveform display.

Select **View > Wave Form View** or click the **Show/Hide Waveform** button on the View Type toolbar to enable the waveform display.

The Compact View shows the OOB Sequence with speed negotiation.

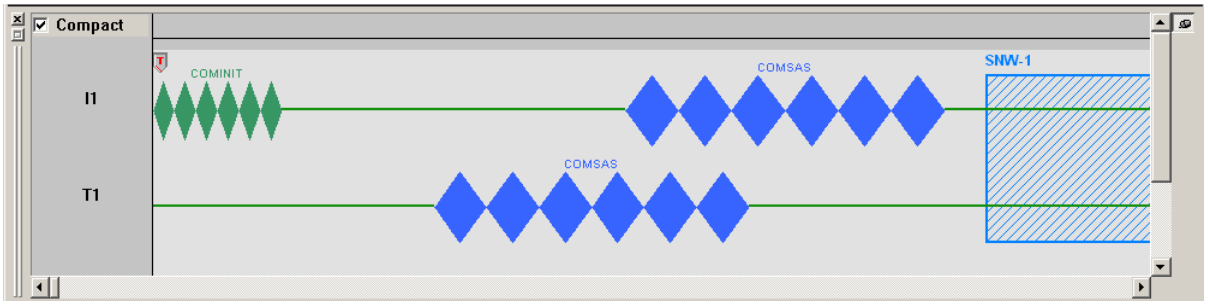


Figure 3.20: SAS: Waveform View

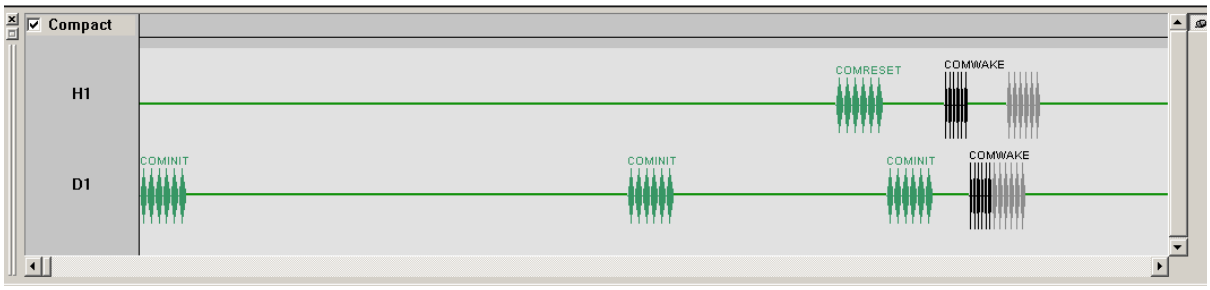


Figure 3.21: SATA: Waveform View

Making a timing Measurement

Timing measurements are made with two timing cursors T1 and T2. Click the left mouse button in the gray bar on the top of the waveform display at a point for the T1 cursor, and the right mouse button at a point for the T2 cursor. The time difference between the cursors is on a line connecting the two cursors.

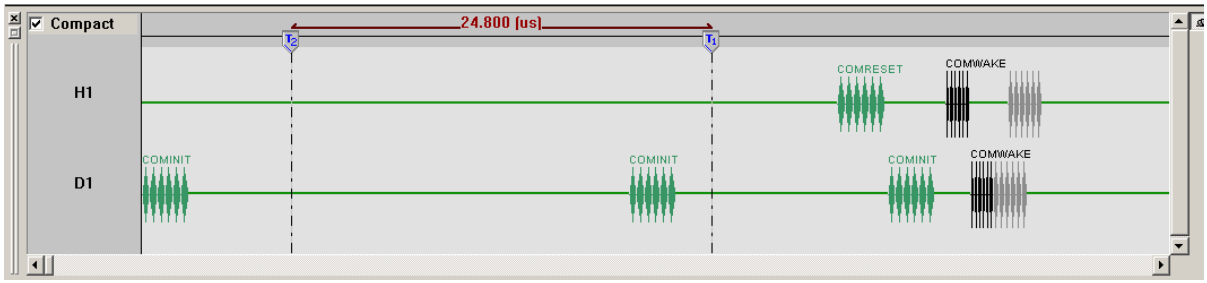


Figure 3.22: SATA: Timing Cursors Enabled

Expanded Waveform View

To see a 10x time scale expansion of the waveform, uncheck the **Compact View** checkbox in the Waveform View window. The OOB Sequence has speed negotiation (Hardware version 4 or later).

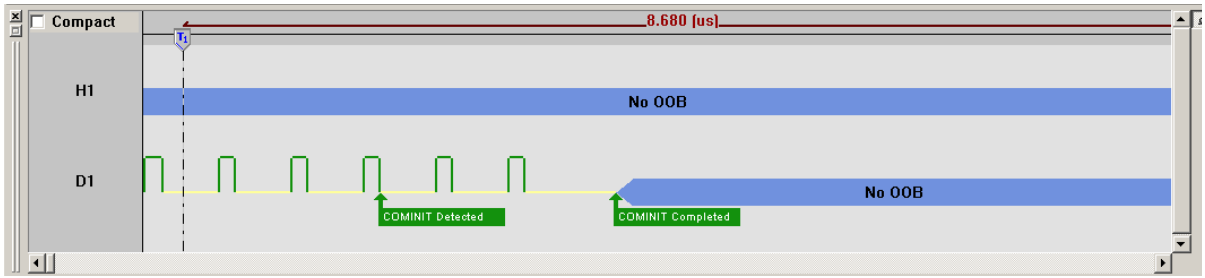


Figure 3.23: SATA: Expanded Waveform View

Statistical Report

Whenever a captured sample is in the Sample Viewer, a **Statistical Report** selection in the **Report** menu and a **Statistical Report Button** on the viewer toolbar are enabled. You can create a Statistical Report for the entire capture or select a portion of it.

To display a Statistical Report, click the **Statistical Report** button on the viewer toolbar or select **Analysis > Statistical Report** to display the **Select Statistical Report Range** dialog.

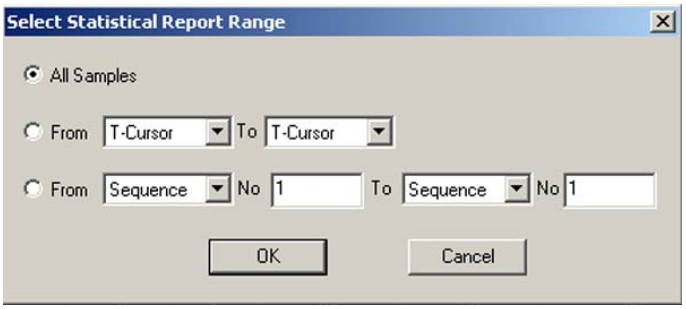


Figure 3.24: Statistical Report Range Dialog

The default statistical report has All Samples. You can set a specific Statistical report range between defined cursor positions or events.

Generating Statistical Read/Write Report

To create a statistical read/write page perform the following steps:

1. Click on the **Setup** menu option and select **Preferences** > **Software Settings**.
2. Click on the **Trace Viewer** tab.
3. Check the box **Create statistical report read/write page**.
   (see Figure 3.25 on page 129).

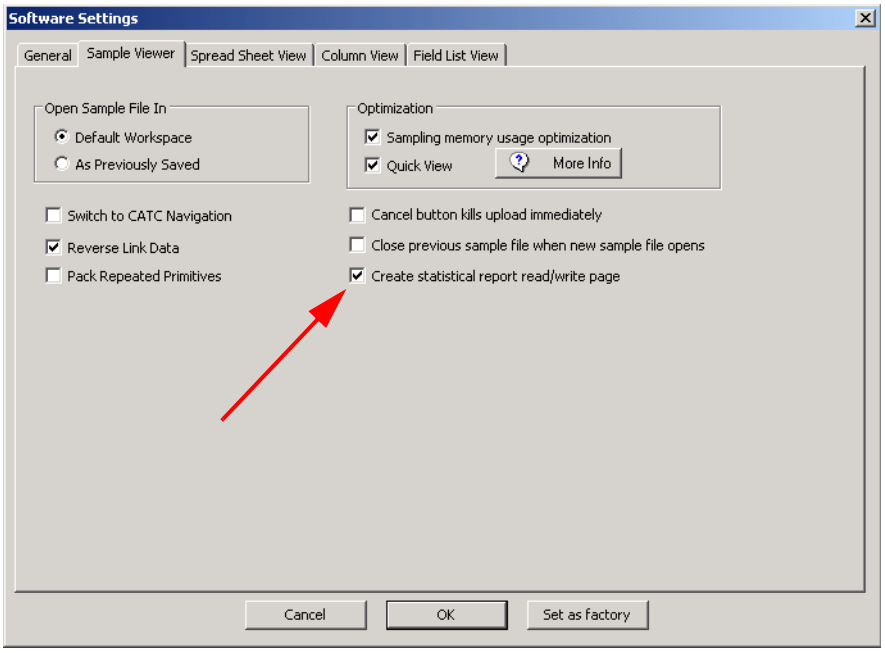


Figure 3.25: Enabling Read/Write Statistical Report

Note: This settings should be enabled before you capture the trace file.

If you have already captured a trace file and want to create a read/write statistical report for the sample, perform the following steps:

1. Enable the read/write settings as mentioned above.
2. Open the trace file.
3. Set the X pointer on the first packet in the viewer.
4. Set the Y pointer on last packet in the viewer.
5. Save as the trace file using the X to Y option.

   Now the saved trace file will contain the read/write statistical report.

Report between Cursors

Click the option button next to the **From** cursor selection drop down list. Then click the **From** down arrow and choose the 1st cursor, click the **To** down arrow to choose the 2nd cursor, and click **OK.** The resulting report has only the capture between the cursors.

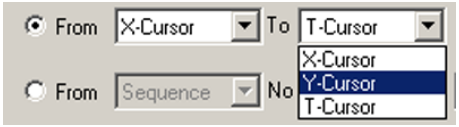


Figure 3.26: Report between Cursors

Report between Events

Click the option button next to the **From** the event selection dropdown list, click the **From** down arrow to choose the 1st event, then enter the number of its occurrence. Next click the **To** down arrow to choose the 2nd event, then enter the number of its occurrence.

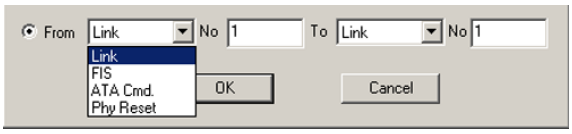


Figure 3.27: SATA: Report between Events

Click **OK.** The resulting report are limited to the capture between the defined events.

SAS vs. SATA: SAS adds Transport, SCSI Cmd, SMP Cmd, and Task Mng to the drop-down list and deletes FIS and Phy Reset.

Statistical Report Content

SAS: A complete SAS statistical report consists of the following reports, accessed by clicking the corresponding tab in the dialog:

- General
- Bus Condition
- Primitive
- SSP Transport
- SMP Transport
- STP Transport
- ATA Command
- SCSI Command
- SMP Command
- Task Command
- SAS Address
- Read/Write Command
- Protocol Error
- Performance
- Lanes
- Others

SATA: A complete SATA statistical report consists of the following reports, accessed by clicking the corresponding tab in the dialog:

- General
- Bus Condition
- Primitive
- FIS
- ATA Command
- ATAPI Command
- Read/Write Command

- Protocol Error
- Performance
- Others
- PM Statistic
- PM Performance

Note: Results are displayed only for items that have been captured in the sample.

Report Options

Some report categories offer options to display only specific items.These report categories incorporate drop-down list boxes offering pre-defined and custom options. For details see "Formatting the Statistical Report View" on page 149.

General Report

To display the General Report, click the **General** tab. The General Report displays the report data in columns with the following information:

- Type: All, Custom, Bus Condition, FIS, Identify Address Frame, Open Address Frame, SMP Frame, SSP Frame, STP Frame
- **Direction**: All, H->D, D->H, I->T, T->I, or Custom
- **Duration**: All, Custom, or time unit
- **Count**: All, Custom, or a number of occurrences
- **%**: of total count

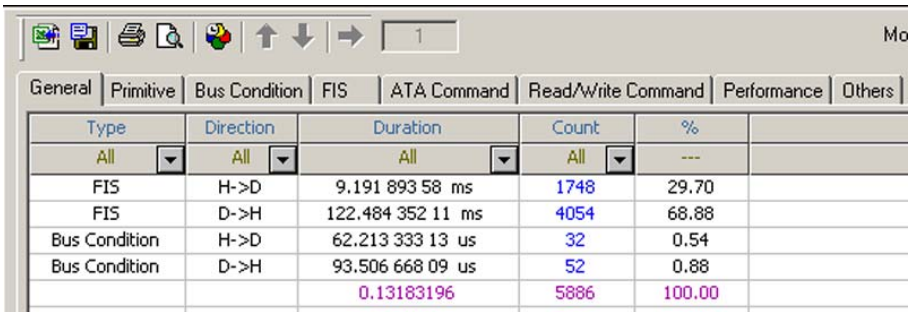
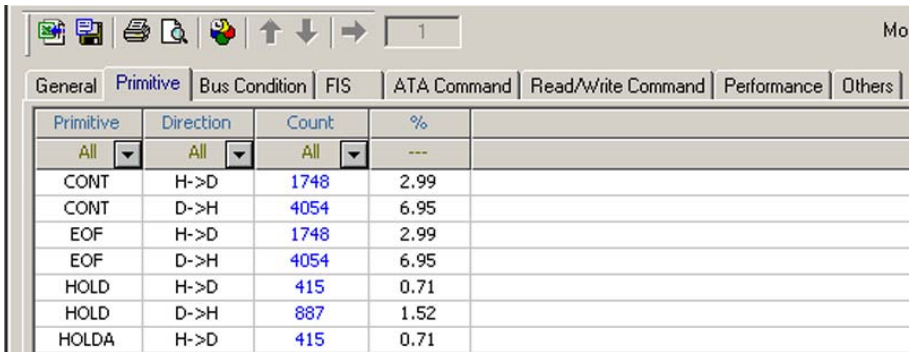


Figure 3.28: General Statistical Report

Primitive Report

To display the Primitive Report, click the **Primitive** tab. The Primitive Report displays information in the following columns:

- **Primitive**: All, Custom, Unknown
  For SATA: CONT, EOF, HOLD, HOLDA, R_IP, R_OK, R_RDY, SOF, SYNC, WTRM, X_RDY, ALIGN
  FOR SAS: SATA_CONT, SATA_EOF, SATA_R_IP, SATA_R_OK, SATA_R_RDY, SATA_SOF, SATA_SYNC, SATA_WTRM, SATA_X_RDY, ACK, EOF, SOF, EOAF, SOAF, AIP_WAITING_ON_DEVICE,AIP_NORMAL, DONE_NORMAL, READY_NORMAL, CLOSE_NORMAL, OPEN_ACCEPT, ALIGN0, ALIGN1, NOTIFY_ENABLE_SPINUP
- **Direction**: All, H->D, D->H, I->T, T->I, or Custom
- **Count**: All, Custom, or a number of occurrences
- **%**: of total count



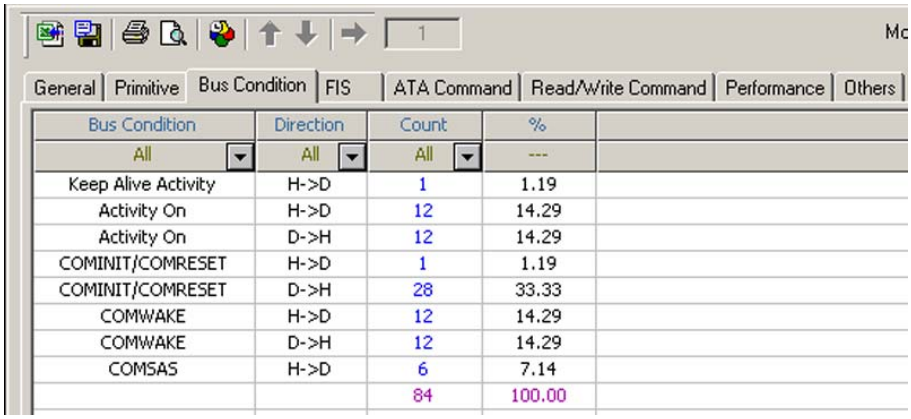
Primitive	Direction	Count	%
All	All	All	---
CONT	H->D	1748	2.99
CONT	D->H	4054	6.95
EOF	H->D	1748	2.99
EOF	D->H	4054	6.95
HOLD	H->D	415	0.71
HOLD	D->H	887	1.52
HOLDA	H->D	415	0.71

Figure 3.29: Primitive Report

Bus Condition Report

To display the Bus Condition Report, click the **Bus Condition** tab. The Bus Condition Report displays information in the following columns.

- Bus Condition: All, Custom, Activity On, COMINIT/COMRESET, COMSAS, COM-WAKE, Keep Alive Activity
- Direction: All, H->D, D->H, I->T, T->I, or Custom
- **Count**: All, Custom, or a number of occurrences
- **%**: of total count



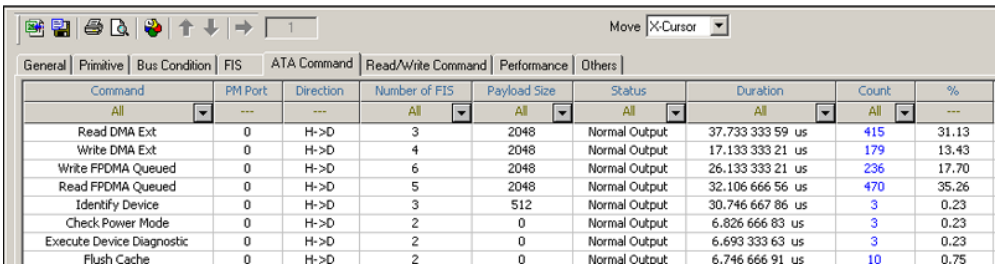
Bus Condition	Direction	Count	%
All	All	All	---
Keep Alive Activity	H->D	1	1.19
Activity On	H->D	12	14.29
Activity On	D->H	12	14.29
COMINIT/COMRESET	H->D	1	1.19
COMINIT/COMRESET	D->H	28	33.33
COMWAKE	H->D	12	14.29
COMWAKE	D->H	12	14.29
COMSAS	H->D	6	7.14
		84	100.00

Figure 3.30: Bus Condition Report

ATA Command Report

To display the ATA Command Report, click the **ATA Command** tab. The ATA Command Report displays information in the following columns:

- Command: All, Custom, Check Power Mode, Execute Device Diagnostic, Flush Cache, Identify Device, Read DMA Ext, Read FPDMA Queue, Set Feature, Write DMA Ext, Write FPDMA Queue
- PM Port
- Direction: All, H->D, D->H, I->T, T->I, or Custom
- Number of FIS: All, Custom, or a number
- **Payload Size**: All, Custom, or a number of DWORDs
- Status: All, Custom, Incomplete, Normal Output
- Timeout: such as All, Custom, N/A, Yes and No (see "Time out of ATA Command Report" on page 134)
- **Duration**: All, Custom, or time unit
- **Count**: All, Custom, or a number of occurrences
- **%**: of total count



Command	PM Port	Direction	Number of FIS	Payload Size	Status	Duration	Count	%
All	---	---	All	All	All	All	All	---
Read DMA Ext	0	H->D	3	2048	Normal Output	37.733 333 59 us	415	31.13
Write DMA Ext	0	H->D	4	2048	Normal Output	17.133 333 21 us	179	13.43
Write FPDMA Queued	0	H->D	6	2048	Normal Output	26.133 333 21 us	236	17.70
Read FPDMA Queued	0	H->D	5	2048	Normal Output	32.106 666 56 us	470	35.26
Identify Device	0	H->D	3	512	Normal Output	30.746 667 86 us	3	0.23
Check Power Mode	0	H->D	2	0	Normal Output	6.826 666 83 us	3	0.23
Execute Device Diagnostic	0	H->D	2	0	Normal Output	6.693 333 63 us	3	0.23
Flush Cache	0	H->D	2	0	Normal Output	6.746 666 91 us	10	0.75

Figure 3.31: SATA: ATA Command Report

Time out of ATA Command Report

The Time out shows the NCQ time out. It is applicable for only NCQ commands. A threshold can be set in the "NCQ commands Timeout Threshold", the default value is 1000 µsec (the user can change it to any value). The statistical report provides a "Time out" report based on this threshold. Any NCQ command that takes more than the given threshold is flagged as "yes", which means that a timeout occurred for that command.

ATAPI Report

To display the ATAPI Report, click the **ATAPI** tab. The ATAPI Report displays information in the following columns (see the following screen capture):

- **Command**: All, Custom, Inquiry, Mode Sense 10, Read10, Request Sense
- **Direction**: All, H->D, D->H, or Custom
- **Number of FIS** or **Number of Transport**: All, Custom, or a number
- **Payload Size**: All, Custom, or a number of DWORDs
- **Status**: All, Custom, Check Condition, Good
- **Duration**: All, Custom, or time unit (accumulative)
- **Count**: All, Custom, or a number of occurrences
- **%:** of total count

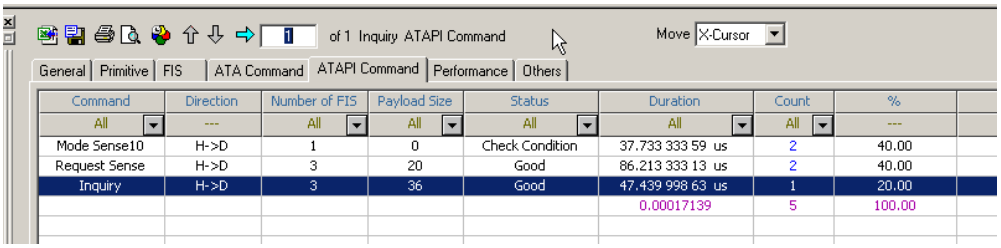

1
of 1 Inquiry ATAPI Command
Move X-Cursor
General Primitive FIS ATA Command ATAPI Command Performance Others
Command Direction Number of FIS Payload Size Status Duration Count %
All --- All All All All All ---
Mode Sense10 H->D 1 0 Check Condition 37.733 333 59 us 2 40.00
Request Sense H->D 3 20 Good 86.213 333 13 us 2 40.00
Inquiry H->D 3 36 Good 47.439 998 63 us 1 20.00
0.00017139 5 100.00

Figure 3.32: SATA: ATAPI Report

Protocol Error Report

To display the Protocol Error Report, click the **Protocol Error** tab.The Protocol Error Report displays the report data in columns with the following information:

- **Protocol Error**: All, Custom, Code Violation, CRC Error, Disparity Error, Align-Notify Error
- Direction: All, H->D, D->H, I->T, T->I, or Custom
- Count: All, Custom, or a number of occurrences
- **%**: of total count

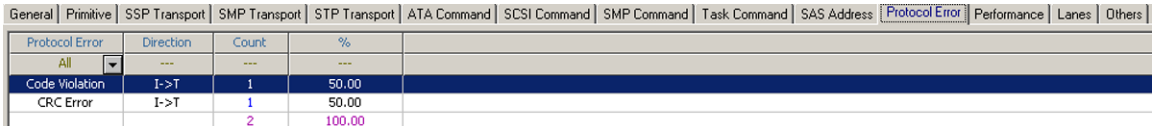

General Primitive SSP Transport SMP Transport STP Transport ATA Command SCSI Command SMP Command Task Command SAS Address Protocol Error Performance Lanes Others
Protocol Error Direction Count %
All --- --- ---
Code Violation I->T 1 50.00
CRC Error I->T 1 50.00
2 100.00

Figure 3.33: SAS: Protocol Error Report

Others Report

To display the Others Report, click the **Others** tab. The Others Report displays information in the following columns (see the following screen capture):

- Items
  - Idle No
  - Payload Size
  - Sample Time
  - Idle (Initiator)
  - Idle (Target)
  - SSP Bus Utilization
  - SMP Bus Utilization
  - STP Bus Utilization
- Report
  - Count or Time

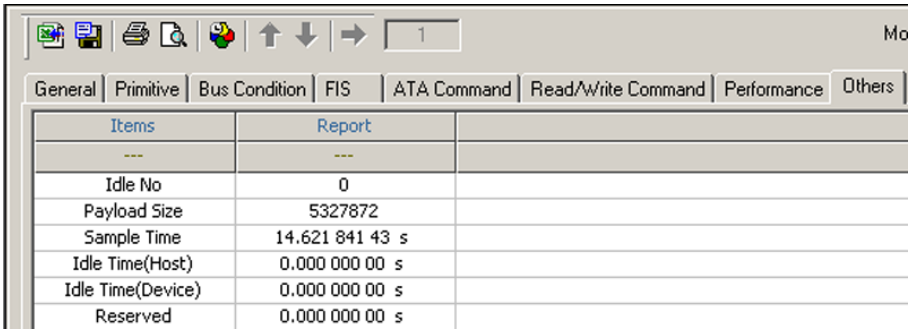


Figure 3.34: Others Report

SSP Transport Report (SAS)

To display the SSP Transport Report, click the **SSP Transport** tab. The SSP Transport Report displays the report data in columns with the following information:

- Type: All, Custom, Command, Data, Response, XFER_RDY
- Direction: All, I->T, T->I, or Custom
- Duration: All, Custom, or time unit
- Count: All, Custom, or a number
- **%:** of total count

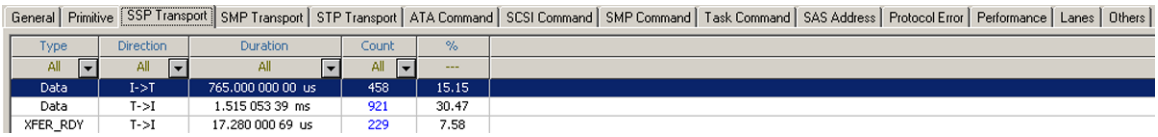


Figure 3.35: SAS: SSP Transport Report

SMP Transport Report (SAS)

To display the SMP Transport Report, click the **SMP Transport** tab. The SMP Transport Report displays the report data in columns with the following information:

- Type: All, Custom, Request, Response
- Direction: All, I->T, T->I, or Custom
- Duration: All, Custom, or time unit
- Count: All, Custom, or a number
- **%:** of total count

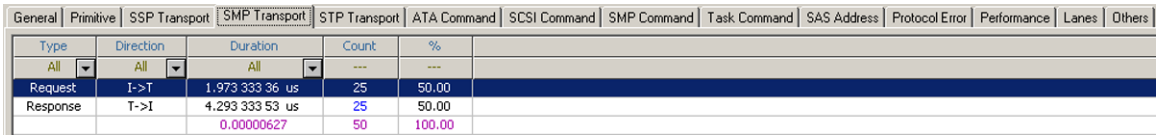


Figure 3.36: SAS: SMP Transport Report

STP Transport Report (SAS)

To display the STP Transport Report, click the **STP Transport** tab. The STP Transport Report displays the report data in columns with the following information:

- FIS Type: All, Custom, Data, PIO Setup, Register Host To Device, Register Device To Host
- PM Port
- Direction: All, I->T, T->I, or Custom
- Duration: All, Custom, or time unit
- Count: All, Custom, or a number
- **%:** of total count

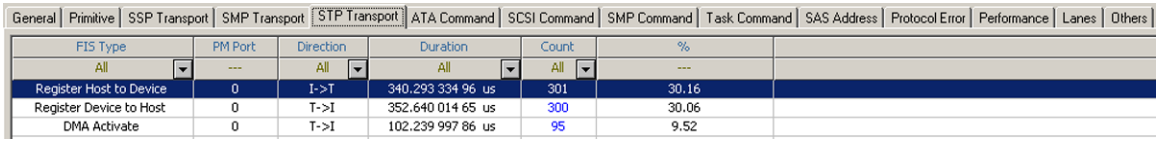


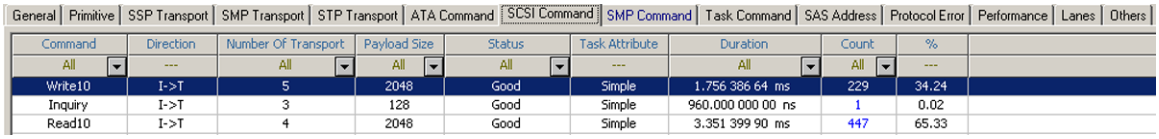
Figure 3.37: SAS: STP Transport Report

SCSI Command Report (SAS)

To display the SCSI Command Report, click the **SCSI Command** tab. The SCSI Command Report displays the report data in columns with the following information (see Figure 3.38 on page 138):

- Command: All, Custom, Inquiry, Mode Sense6, Pause Resume, Play Audio 10, Read Capacity, Read10, Receive Diagnostic Results, Send Diagnostic, Write10, Start Stop Unit, Test Unit Ready, Report Luns, Synchronize Cache10
- Direction: All, I->T, T->I, or Custom
- Number of Transport: All, Custom, or a number

- Payload Size: All, Custom, or a number of DWORDs
- Status: All, Custom, Good, Incomplete, Response Data Present
- Task Attribute: Simple
- Duration: All, Custom, or time unit
- Count: All, Custom, or a number
- %: of total count



General | Primitive | SSP Transport | SMP Transport | STP Transport | ATA Command | SCSI Command | SMP Command | Task Command | SAS Address | Protocol Error | Performance | Lanes | Others

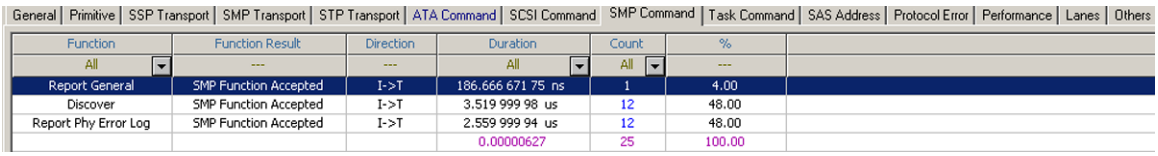
Command	Direction	Number Of Transport	Payload Size	Status	Task Attribute	Duration	Count	%
All	---	All	All	All	---	All	All	---
Write10	I->T	5	2048	Good	Simple	1.756 386 64 ms	229	34.24
Inquiry	I->T	3	128	Good	Simple	960.000 000 00 ns	1	0.02
Read10	I->T	4	2048	Good	Simple	3.351 399 90 ms	447	65.33

Figure 3.38: SAS: SCSI Command Report

SMP Command Report (SAS)

To display the SMP Command Report, click the **SMP Command** tab. The SMP Command Report displays the report data in columns with the following information:

- Function: All, Custom, Discover, Report General, Report Manufacture Information, Report PHY Error Log
- Function Result: SMP Function Accepted
- Direction: All, I->T, T->I, or Custom
- Duration: All, Custom, or time unit
- Count: All, Custom, or a number
- **%:** of total count



General | Primitive | SSP Transport | SMP Transport | STP Transport | ATA Command | SCSI Command | SMP Command | Task Command | SAS Address | Protocol Error | Performance | Lanes | Others

Function	Function Result	Direction	Duration	Count	%
All	---	---	All	All	---
Report General	SMP Function Accepted	I->T	186.666 671 75 ns	1	4.00
Discover	SMP Function Accepted	I->T	3.519 999 98 us	12	48.00
Report Phy Error Log	SMP Function Accepted	I->T	2.559 999 94 us	12	48.00
			0.00000627	25	100.00

Figure 3.39: SAS: SMP Command Report

Task Command Report (SAS)

To display the Task Command Report, click the **TASK Command** tab. The Task Command Report displays the report data in columns with the following information (see Figure 3.40 on page 139):

- Function
- Status
- Direction: All, I->T, T->I, or Custom
- Duration: All, Custom, or time unit
- Count: All, Custom, or a number
- **%:** of total count

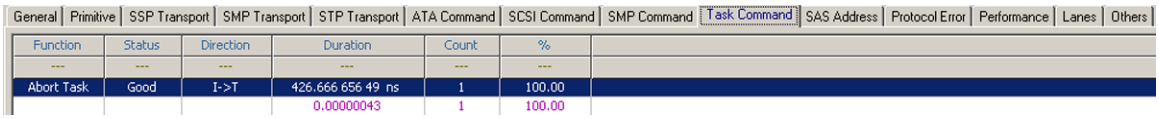

General | Primitive | SSP Transport | SMP Transport | STP Transport | ATA Command | SCSI Command | SMP Command | Task Command | SAS Address | Protocol Error | Performance | Lanes | Others
Function | Status | Direction | Duration | Count | %
Abort Task | Good | I->T | 426.666 656 49 ns | 1 | 100.00
0.00000043 | 1 | 100.00

Figure 3.40: SAS: TASK Command Report

SAS Address Report (SAS)

To display the SAS Address Report, click the **SAS Address** tab.The SAS Address Report displays the report data in columns with the following information:

- Source SAS Address: All, Custom, or an address
- Destination SAS Address: All, Custom, or an address
- Protocol Type: SMP, SSP, STP
- Frame Type: All, Custom, Command, Data, DMA Activate, Register Host To Device, Register Device To Host, Response, XFER_RDY
- **Count**: All, Custom, or a number

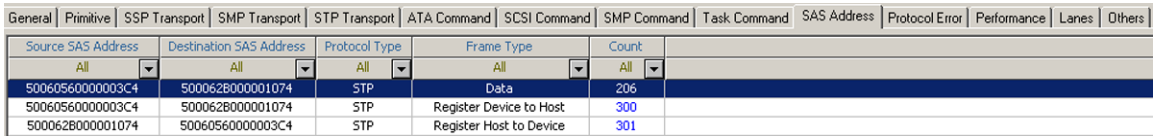

General | Primitive | SSP Transport | SMP Transport | STP Transport | ATA Command | SCSI Command | SMP Command | Task Command | SAS Address | Protocol Error | Performance | Lanes | Others
Source SAS Address | Destination SAS Address | Protocol Type | Frame Type | Count
All | All | All | All | All
50060560000003C4 | 500062B000001074 | STP | Data | 206
50060560000003C4 | 500062B000001074 | STP | Register Device to Host | 300
500062B000001074 | 50060560000003C4 | STP | Register Host to Device | 301

Figure 3.41: SAS: SAS Address Report

Lanes Report (SAS)

To display the Lanes Report, click the **Lanes** tab. The Lanes Report displays the report data in columns with the following information:

- Port
- Open Accept: All, Custom, or a number
- Open Reject: All, Custom, or a number
- AIP Waiting on Con.
- Break
- SCSI Command: All, Custom, or a number
- ATA Command: All, Custom, or a number
- SMP Command: All, Custom, or a number
- Out Standing Command: All, Custom, or a number
- Transfer Bytes: All, Custom, or a number
- Link Utilization (time)
- Link Utilization %

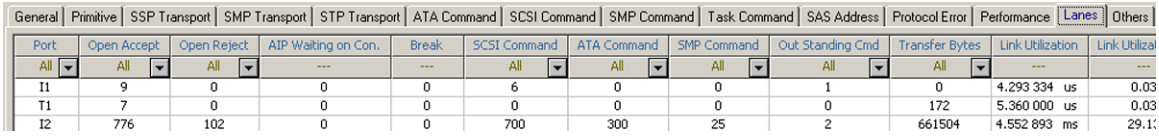

General | Primitive | SSP Transport | SMP Transport | STP Transport | ATA Command | SCSI Command | SMP Command | Task Command | SAS Address | Protocol Error | Performance | Lanes | Others
Port | Open Accept | Open Reject | AIP Waiting on Con. | Break | SCSI Command | ATA Command | SMP Command | Out Standing Cmd | Transfer Bytes | Link Utilization
All
I1 | 9 | 0 | 0 | 0 | 6 | 0 | 0 | 1 | 0 | 4.293 334 us
T1 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 172 | 5.360 000 us
I2 | 776 | 102 | 0 | 0 | 700 | 300 | 25 | 2 | 661504 | 4.552 893 ms

Figure 3.42: SAS Lanes Report

Read/Write Command Report (SAS)

To display the Read/Write Command Report, click the **Read/Write Command** tab. You can enable or disable creation of this page under Software Settings (see "Software Settings" on page 203). The Read/Write Command report displays the report data in columns with the following information:

- Source SAS Address
- Destination SAS Address
- Protocol Type
- OpCode/Command
- Tag
- LBA
- Sector Count
- Xfer Length
- Payload Size: All, Custom, or a number of DWORDs
- Status: All, Custom, Good
- Completion Time
- Performance
- Standard Deviation
- **Count**: All, Custom, or a number

Figure 3.43: SAS: Read Write Command Report

Performance Report (SAS)

To display the Performance Report, click the **Performance** tab.The Performance Report displays the report data in columns with the following information (see Figure 3.44 on page 141):

- Minimum Completion Time
- Average Completion Time
- Maximum Completion Time
- Initiator Bus Utilization
- Target Bus Utilization
- Efficiency
- Total Read Cmd
- Total Read (Bytes)
- Total Read Duration
- Cmd Minimum Read (MB/S)
- Cmd Average Read (MB/S)
- Cmd Maximum Read (MB/S)
- Total Write Cmd
- Total Write (Bytes)

- Total Write Duration
- Cmd Minimum Write (MB/S)
- Cmd Average Write (MB/S)
- Cmd Maximum Write (MB/S)
- Average Byte per SSP Frame
- Average Byte per STP Frame

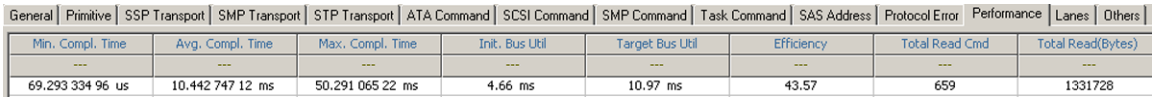

General | Primitive | SSP Transport | SMP Transport | STP Transport | ATA Command | SCSI Command | SMP Command | Task Command | SAS Address | Protocol Error | Performance | Lanes | Others
Min. Compl. Time | Avg. Compl. Time | Max. Compl. Time | Init. Bus Util | Target Bus Util | Efficiency | Total Read Cmd | Total Read(Bytes)
69.293 334 96 us | 10.442 747 12 ms | 50.291 065 22 ms | 4.66 ms | 10.97 ms | 43.57 | 659 | 1331728

Figure 3.44: SAS: Performance Report

Performance Report (SATA)

To display the Performance Report, click the **Performance** tab. The Performance Report displays information in the following columns (see the following screen capture):

- Minimum Completion Time
- Average Completion Time
- Maximum Completion Time
- Host Bus Utilization
- Device Bus Utilization
- Efficiency (%)
- Total Read Cmd
- Total Read (Bytes)
- Total Read Duration
- Cmd Minimum Read (MB/S)
- Cmd Average Read (MB/S)
- Cmd Maximum Read (MB/S)
- Total Write Cmd
- Total Write (Bytes)
- Total Write Duration
- Cmd Minimum Write (MB/S)
- Cmd Average Write (MB/S)
- Cmd Maximum Write (MB/S)
- Average Byte Per FIS
- FIS Minimum Difference Time
- FIS Average Difference Time
- FIS Maximum Difference Time

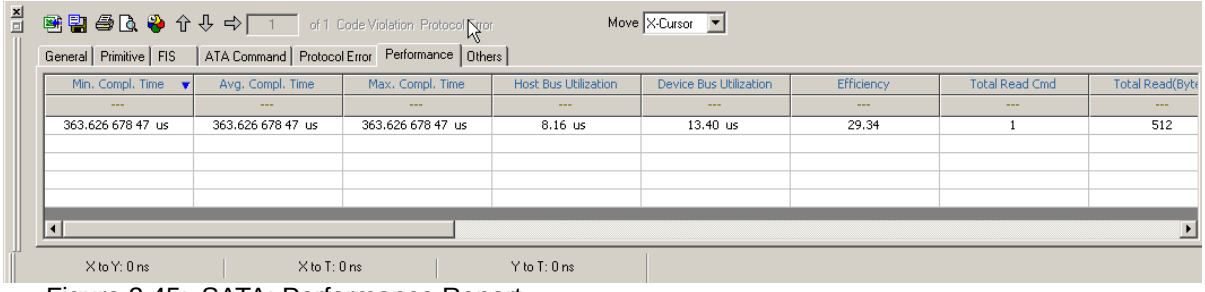
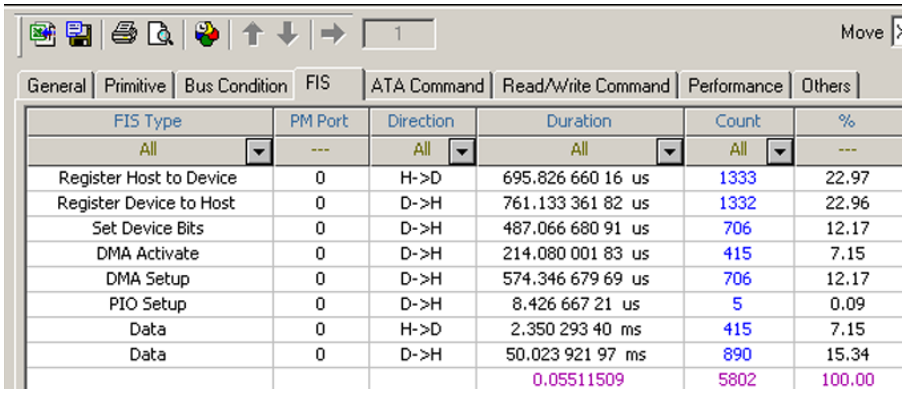

Move X-Cursor
General | Primitive | FIS | ATA Command | Protocol Error | Performance | Others
Min. Compl. Time | Avg. Compl. Time | Max. Compl. Time | Host Bus Utilization | Device Bus Utilization | Efficiency | Total Read Cmd | Total Read(Byte
363.626 678 47 us | 363.626 678 47 us | 363.626 678 47 us | 8.16 us | 13.40 us | 29.34 | 1 | 512
X to Y: 0 ns | X to T: 0 ns | Y to T: 0 ns

Figure 3.45: SATA: Performance Report

FIS Report (SATA)

To display the FIS Report, click the **FIS** tab. The FIS Report displays information in the following columns:

- **FIS Type**: All, Custom, Data, PIO Setup, Register Host To Device, Register Device To Host
- PM Port
- **Direction**: All, H->D, D->H, or Custom
- **Duration**: All, Custom, or time unit (accumulative)
- **Count**: All, Custom, or a number of occurrences
- **%:** of total count

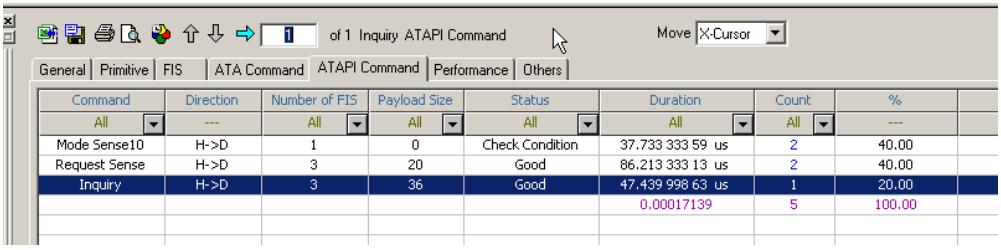


FIS Type	PM Port	Direction	Duration	Count	%
All	---	All	All	All	---
Register Host to Device	0	H->D	695.826 660 16 us	1333	22.97
Register Device to Host	0	D->H	761.133 361 82 us	1332	22.96
Set Device Bits	0	D->H	487.066 680 91 us	706	12.17
DMA Activate	0	D->H	214.080 001 83 us	415	7.15
DMA Setup	0	D->H	574.346 679 69 us	706	12.17
PIO Setup	0	D->H	8.426 667 21 us	5	0.09
Data	0	H->D	2.350 293 40 ms	415	7.15
Data	0	D->H	50.023 921 97 ms	890	15.34
			0.05511509	5802	100.00

Figure 3.46: SATA: FIS Report

Queue Command Report (SATA)

- To display the Queue Command Report, click the **Queue Command** tab. The Queue Command Report displays information in the following columns:
- **Command**: All, Custom, Read DMA Queued
- PM Port
- **Status**: All, Custom, Normal Output
- **Payload Size**: All, Custom, or a number of DWORDs
- **Direction**: All, H->D, D->H, or Custom
- **Duration**: All, Custom, or time unit (accumulative)
- **Count**: All, Custom, or a number of occurrences
- **%:** of total count



Command	Direction	Number of FIS	Payload Size	Status	Duration	Count	%
All	---	All	All	All	All	All	---
Mode Sense10	H->D	1	0	Check Condition	37.733 333 59 us	2	40.00
Request Sense	H->D	3	20	Good	86.213 333 13 us	2	40.00
Inquiry	H->D	3	36	Good	47.439 998 63 us	1	20.00
					0.00017139	5	100.00

Figure 3.47: SATA: Queue Command Report

PM Statistic Report (SATA)

To display the PM Statistic Report, click the **PM Statistic** tab. The PM Statistic Report displays information in the following columns:

- Request Type: PMREQ_P
- Request Port
- Response Type: All, Custom, PMACK
- Response Time
- Request Entering Delay
- Response Entering Delay
- Wakeup Type
- Request DC Idle Time
- Response DC Idle Time
- Request Wakeup Time
- Response Wakeup Time
- Count: All, Custom, or a number

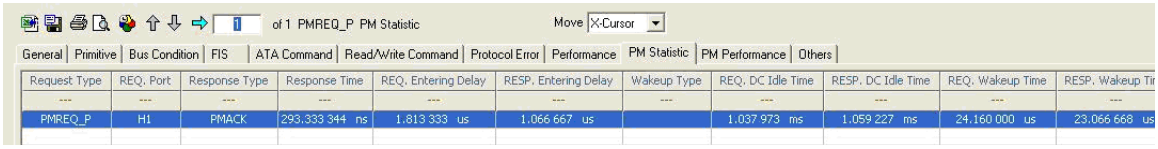

1 of 1 PMREQ_P PM Statistic
Move X-Cursor
General | Primitive | Bus Condition | FIS | ATA Command | Read/Write Command | Protocol Error | Performance | PM Statistic | PM Performance | Others
Request Type | REQ. Port | Response Type | Response Time | REQ. Entering Delay | RESP. Entering Delay | Wakeup Type | REQ. DC Idle Time | RESP. DC Idle Time | REQ. Wakeup Time | RESP. Wakeup Ti
PMREQ_P | H1 | PMACK | 293.333 344 ns | 1.813 333 us | 1.066 667 us | | 1.037 973 ms | 1.059 227 ms | 24.160 000 us | 23.066 668 us

Figure 3.48: SATA: PM Statistic Report

PM Performance Report (SATA)

To display the PM Performance Report, click the **PM Performance** tab. The PM Performance Report displays information in the following columns:

- Port
- Partial Request
- Partial ACKed
- Partial NACKed
- Slumber Request
- Slumber ACKed
- Slumber NACKed
- Partial Time / Slumber Time %
- Partial Time / Total Time %
- **Slumber Time / Total Time %**

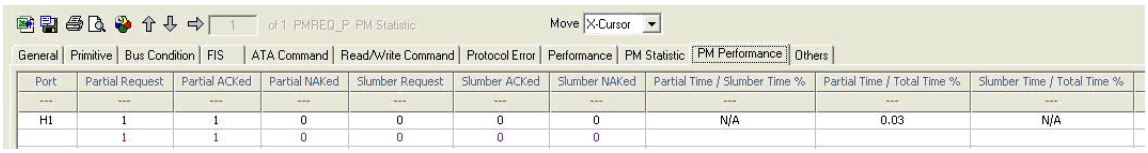

1 of 1 PMREQ_P PM Statistic
Move X-Cursor
General | Primitive | Bus Condition | FIS | ATA Command | Read/Write Command | Protocol Error | Performance | PM Statistic | PM Performance | Others
Port | Partial Request | Partial ACKed | Partial NAKed | Slumber Request | Slumber ACKed | Slumber NAKed | Partial Time / Slumber Time % | Partial Time / Total Time % | Slumber Time / Total Time %
H1 | 1 | 1 | 0 | 0 | 0 | 0 | N/A | 0.03 | N/A

Figure 3.49: SATA: PM Performance Report

Read Write Command Report (SATA)

To display the Read/Write Command Report, click the **Read/Write Command** tab. You can enable or disable creation of this page under Software Settings (see page 203). The Read/Write Command Report displays information in the following columns:

- Time Stamp
- OpCode/Command
- LBA
- Sector Count
- Payload Size: All, Custom, or a number of DWORDs
- Status: All, Custom, Good
- Completion Time
- Count: All, Custom, or a number

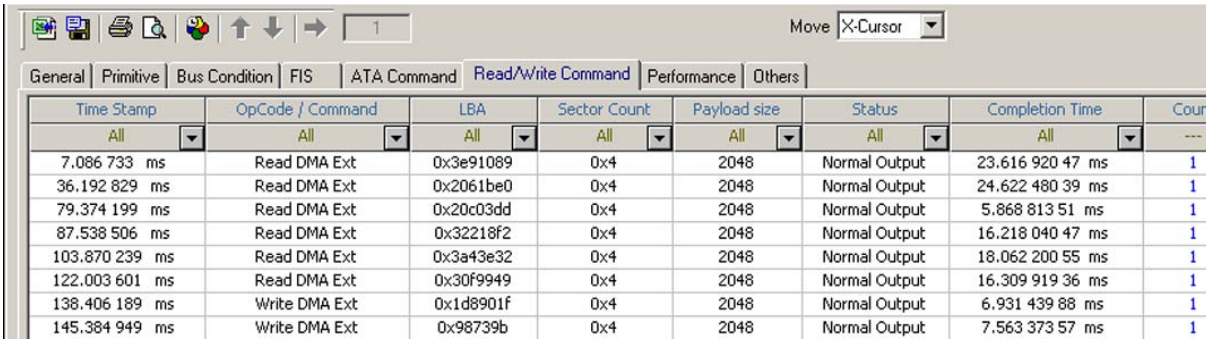

Move X-Cursor
General
Primitive
Bus Condition
FIS
ATA Command
Read/Write Command
Performance
Others
Time Stamp
OpCode / Command
LBA
Sector Count
Payload size
Status
Completion Time
Cour
All
7.086 733 ms Read DMA Ext 0x3e91089 0x4 2048 Normal Output 23.616 920 47 ms 1
36.192 829 ms Read DMA Ext 0x2061be0 0x4 2048 Normal Output 24.622 480 39 ms 1
79.374 199 ms Read DMA Ext 0x20c03dd 0x4 2048 Normal Output 5.868 813 51 ms 1
87.538 506 ms Read DMA Ext 0x32218f2 0x4 2048 Normal Output 16.218 040 47 ms 1
103.870 239 ms Read DMA Ext 0x3a43e32 0x4 2048 Normal Output 18.062 200 55 ms 1
122.003 601 ms Read DMA Ext 0x30f9949 0x4 2048 Normal Output 16.309 919 36 ms 1
138.406 189 ms Write DMA Ext 0x1d8901f 0x4 2048 Normal Output 6.931 439 88 ms 1
145.384 949 ms Write DMA Ext 0x98739b 0x4 2048 Normal Output 7.563 373 57 ms 1

Figure 3.50: SATA: Read Write Command Report

Statistical Report Toolbar

The Statistical Report toolbar provides the following functions accessible by buttons on the toolbar:

- Export to Excel
- Save as Text
- Print Report
- Print Preview
- Report Display Settings
- Move to **X-Cursor, Y-Cursor**, or **None**

Export as Microsoft® Excel file

The **Export to Excel** button opens the Export to Excel dialog. Choose a folder in which to save the Excel file, choose an appropriate file name, and click **Save.**

Save as Text file

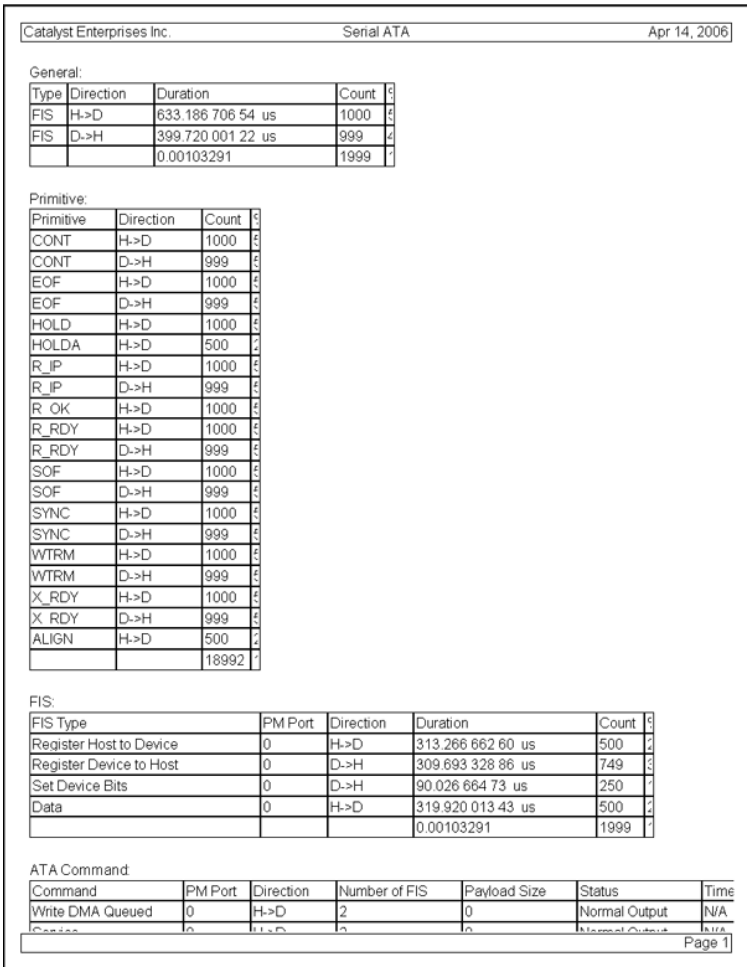
The **Save as Text** button opens the Export to Text dialog. Choose a folder in which to save the Text file, choose an appropriate file name, and click **Save.**

Print Statistical Report

The **Print** button opens the select printer dialog. Choose an available printer and click **OK.**

Print Preview

The **Print Preview** button displays a preview of the report to print**.**



Catalyst Enterprises Inc. Serial ATA Apr 14, 2006

General:

Type	Direction	Duration	Count
FIS	H->D	633.186 706 54 us	1000
FIS	D->H	399.720 001 22 us	999
		0.00103291	1999

Primitive:

Primitive	Direction	Count
CONT	H->D	1000
CONT	D->H	999
EOF	H->D	1000
EOF	D->H	999
HOLD	H->D	1000
HOLDA	H->D	500
R_IP	H->D	1000
R_IP	D->H	999
R_OK	H->D	1000
R_RDY	H->D	1000
R_RDY	D->H	999
SOF	H->D	1000
SOF	D->H	999
SYNC	H->D	1000
SYNC	D->H	999
WTRM	H->D	1000
WTRM	D->H	999
X_RDY	H->D	1000
X_RDY	D->H	999
ALIGN	H->D	500
		18992

FIS:

FIS Type	PM Port	Direction	Duration	Count
Register Host to Device	0	H->D	313.266 662 60 us	500
Register Device to Host	0	D->H	309.693 328 86 us	749
Set Device Bits	0	D->H	90.026 664 73 us	250
Data	0	H->D	319.920 013 43 us	500
			0.00103291	1999

ATA Command:

Command	PM Port	Direction	Number of FIS	Payload Size	Status	Time
Write DMA Queued	0	H->D	2	0	Normal Output	N/A

Page 1

Figure 3.51: Sample Print Preview of Report

Report Display Settings

The **Setting** button opens the Setting dialog.

You can set up the report columns for display to suit a particular analysis need, eliminating the need to show/hide columns individually. Use the **Setting** dialog to configure the display for each page.

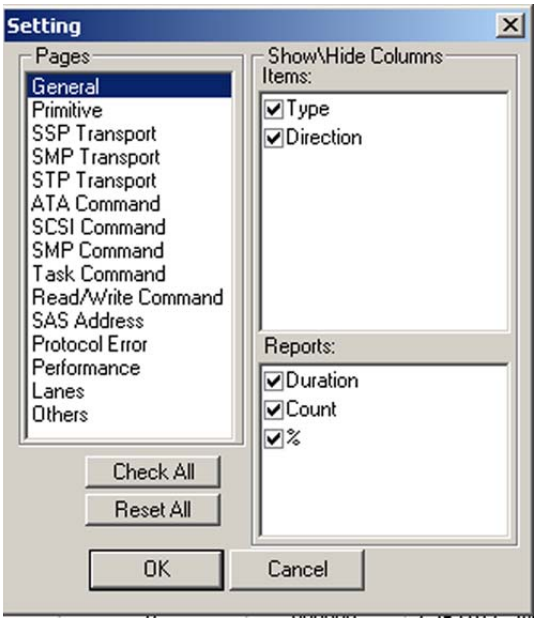


Figure 3.52: SAS: Statistical Report Column Setting

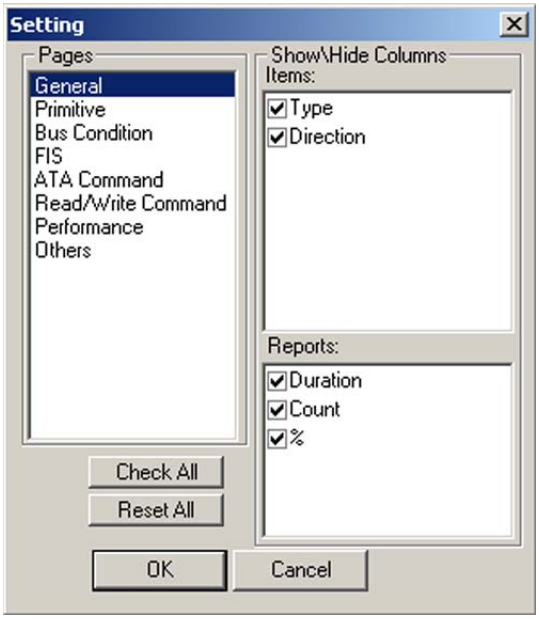
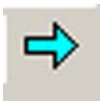


Figure 3.53: SATA: Statistical Report Column Setting

Link With Sample View

When you select a type on any page of the Statistical Report, a set of navigation buttons allows you to examine each instance of that type in the Sample Viewer.

	The **Jump to Previous** button goes to the previous instance of the selected type in the Sample Viewer**.**
	The **Jump to Next** button goes to the next instance of the selected type in the Sample Viewer**.**
	The **Jump to Specific** button goes to the instance specified as N of M items on the Statistical Report toolbar**.**
	The **Move** drop-down list moves to the X-Cursor, Y-Cursor, or None**.**

Formatting the Statistical Report View

Initially the Statistical Report View contains all of the information in columns, but you can customize the display by:

- Filtering columns by item
- Sorting items by column
- Hiding any column on the display

Filtering Column Content

To filter column content, click the down arrow in the heading for that column and choose the items to display. The default is All. By checking a specific item, you exclude everything but that item for display.

.

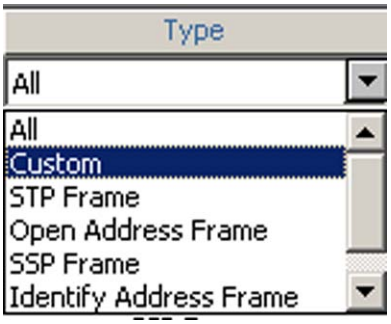


Figure 3.54: SAS: Type

Choosing **Custom** allows you to specify more than one item for display.

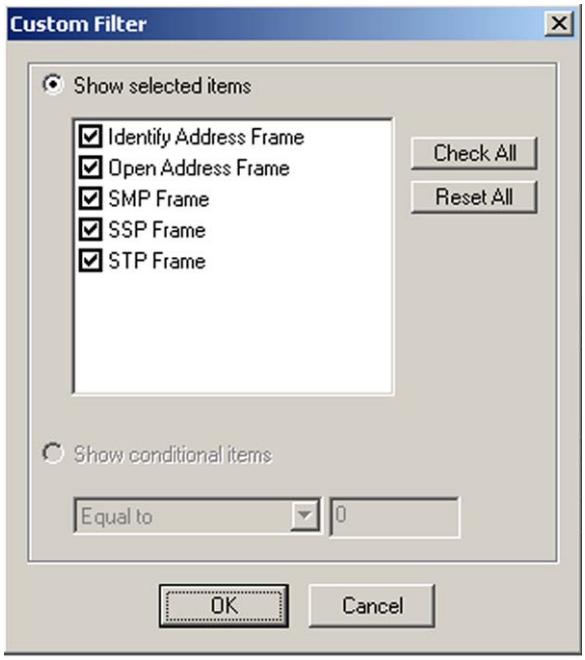


Figure 3.55: SAS: Custom Filter

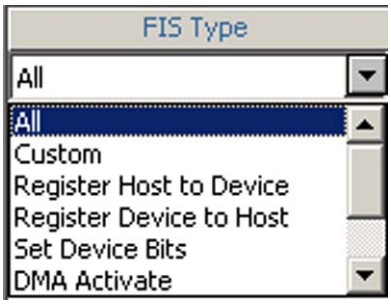


Figure 3.56: SATA: FIS Type

Choosing **Custom** allows you to specify more than one item for display.

Figure 3.57: SATA: Custom Filter

Check the items to display and click **OK**.

Sorting Column Content

To sort column content, click the **heading** for that column. Repeated clicking of the column heading sorts the column in ascending or descending order.

Type	Direction	Duration	Count	%
All	All	All	All	---
Open Address Frame	I->T	18.39999962 us	69	28.51
SMP Frame	T->I	4.53333330 us	17	7.02
SMP Frame	I->T	1.81333339 us	17	7.02
SSP Frame	T->I	23.12000084 us	53	21.90
SSP Frame	I->T	14.48000050 us	35	14.46
STP Frame	T->I	85.89333344 us	34	14.05
STP Frame	I->T	7.03999996 us	17	7.02
		0.00015528	242	100.00

Type	Direction	Duration	Count	%
All	All	All	All	---
STP Frame	I->T	7.03999996 us	17	7.02
STP Frame	T->I	85.89333344 us	34	14.05
SSP Frame	I->T	14.48000050 us	35	14.46
SSP Frame	T->I	23.12000084 us	53	21.90
SMP Frame	I->T	1.81333339 us	17	7.02
SMP Frame	T->I	4.53333330 us	17	7.02
Open Address Frame	I->T	18.39999962 us	69	28.51
		0.00015528	242	100.00

Figure 3.58: Toggling Type Sort Order

Hiding Columns

To hide a column, right-click in the column and choose **Hide**. To unhide a column, right-click any column and choose **Unhide**.

Histogram View

The Histogram View displays a histogram of frame-type transfers.

To display the Histogram View of the current capture, click **View > Histogram View** or click the button on the View Type toolbar.

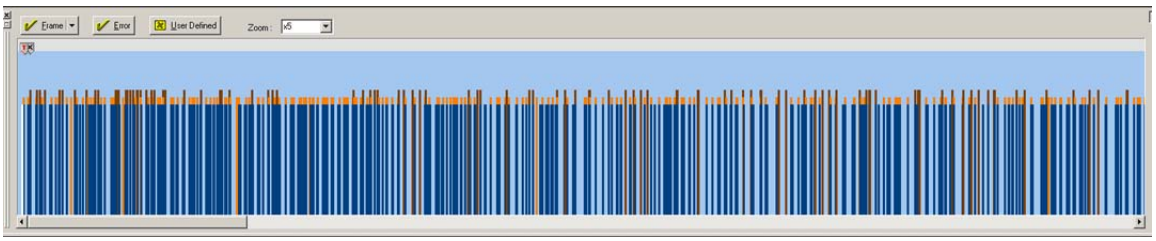


Figure 3.59: Histogram View

Hide Frames

You can customize the histogram by including only frame types that you want.

To choose frame types to include in the display, click the down arrow on the **Frame** button on the Histogram toolbar and check frame types:

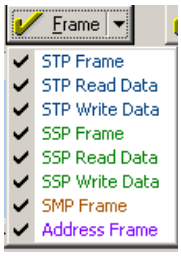


Figure 3.60: SAS: Histogram Frames

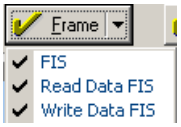


Figure 3.61: SAS: Histogram Frames

Hide Error Frames

Frames with errors are displayed in red. To hide error frames from the histogram, click the

button.

Note: To display the error code of a protocol error, click the error icon (with the red 'x').

Pending IO Graph

The Tool menu has a Pending IO Graph command, with horizontal zoom, vertical zoom, click and drag zoom, graph area zoom, synchronize with trace view, fit to graph area and graph view.

User Defined

You can define additional items for inclusion in the Histogram by clicking the

button to open the User Defined dialog.

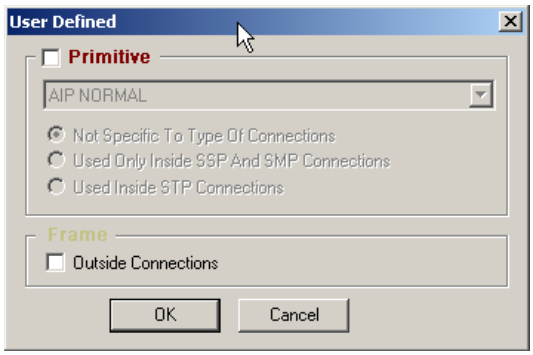


Figure 3.62: SAS: Histogram User Defined Dialog

You can include Primitive and/or Outside Connections frames.

Primitives

To include Primitives, check the **Primitive** check box, click the down arrow on the Primitive list box, and choose a Primitive.

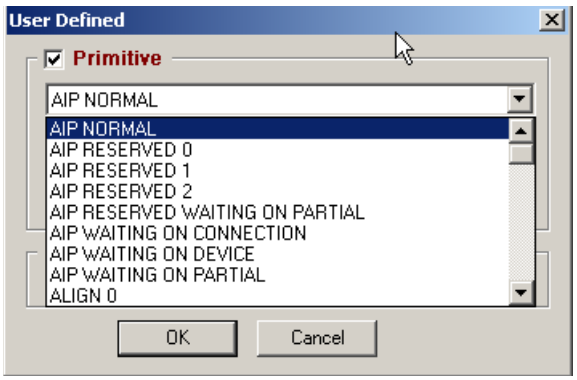


Figure 3.63: SAS: Choosing a Primitive

Figure 3.64: SATA: Choosing a Primitive

Check a Connection Type option radio button, if available, and click **OK**.

Zoom

You can Zoom from x1 to x256.

Bus Utilization View

The Bus Utilization View displays information on pending IO. To display the Bus Utilization View of the current capture,

click **View > Bus Utilization View** or click the button on the View Type toolbar.

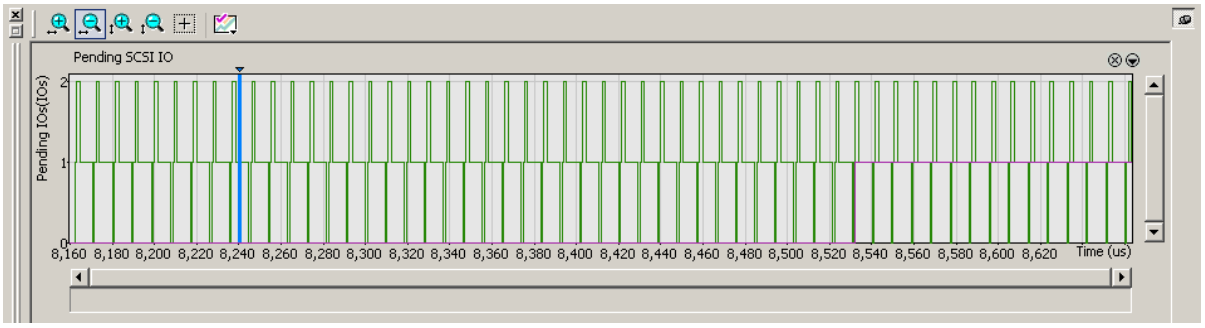


Figure 3.65: SAS: Bus Utilization View for Pending SCSI IO.

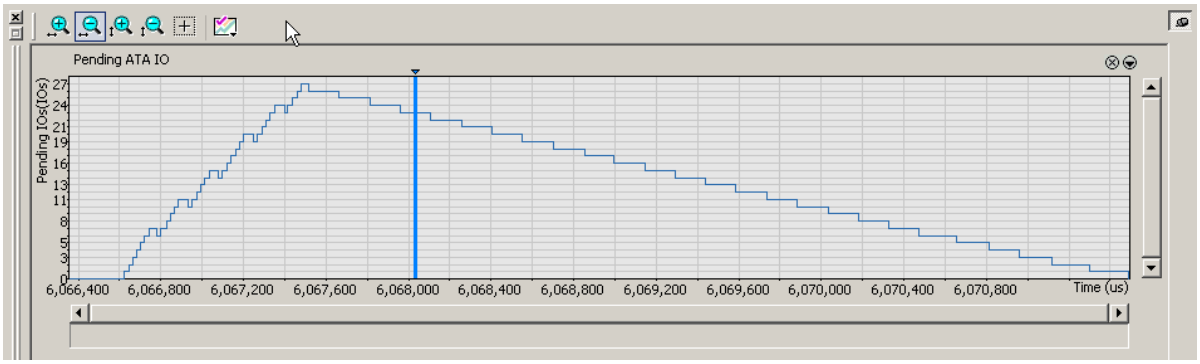


Figure 3.66: SATA: Bus Utilization View for Pending ATA IO

Available Bus Utilization Views are:

- Pending SCSI IO (for SAS)
- Pending ATA IO (for SATA)

Hovering the mouse over the graph heading displays the graph legend:

- **Go to ATA/SCSI Cmd. #**: Jump to command.
- **Synchronize with Trace View**: Synchronize all open views to that location in the trace.
- **Fit to Graph Area**: Zoom to fit.
- **Hide**: Do not display the graph.

To synchronize all open views to that location in the trace, double-click the graph.

Bus Utilization Buttons

The Bus Utilization window has a row of buttons for changing the format of the displayed data. The buttons have the following functions:

	Horizontal zoom in		Vertical zoom in
	Horizontal zoom out		Vertical zoom out
	Graph Areas Presents options for displaying additional graphs.		Click and Drag zoom Click diagonally to select and zoom in on part of the graph.
	Hide graph.		Graph legend (see previous page)

Data Report

When a captured sample is in the Sample Viewer, the Data Report button is on the Viewer toolbar, and Data Report is in the Report menu.

The data report displays all the data sent from the host to the device and from the device to the host. All PIO In =>In commands are grouped as a data packet until the occurrence of a PIO Out =>Out command, creating a new data packet.

To display a Data Report, click the **Data Report** button on the Viewer toolbar or select **Report > Data Report**.

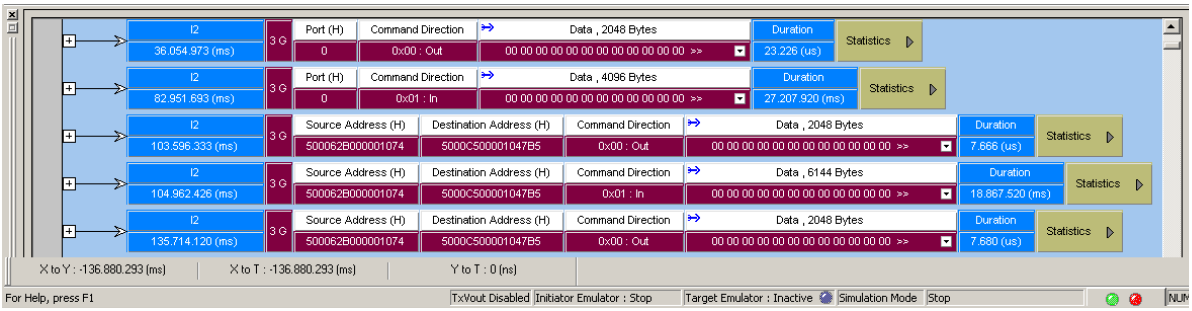


Figure 3.67: SAS: Data Report

Click the **Down Arrow** in a data field to display Data Report details (see Figure 3.68 on page 156).

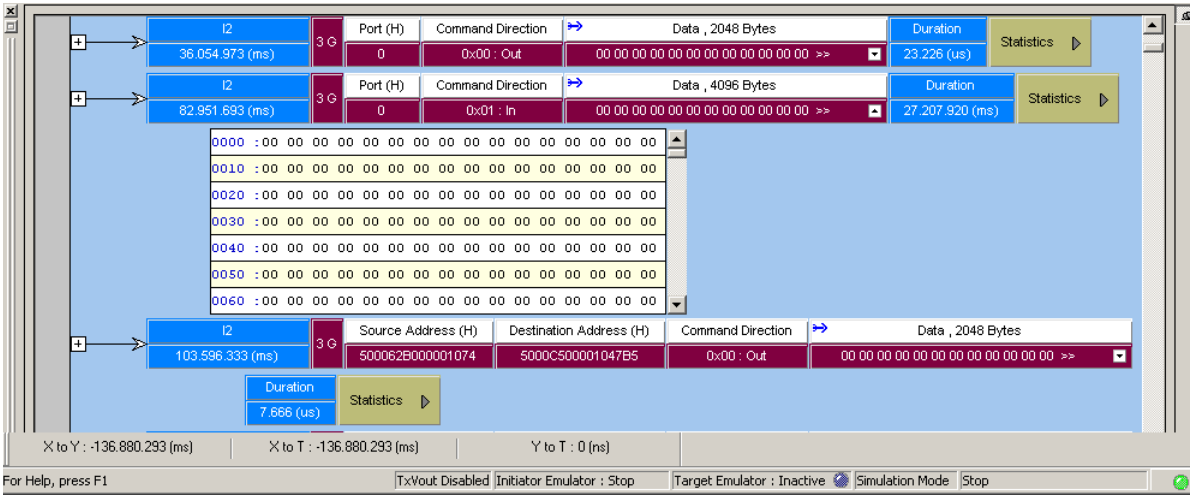


Figure 3.68: SAS: Data Report Details

Click the **Statistics** button at the end of a row to display data report statistics.

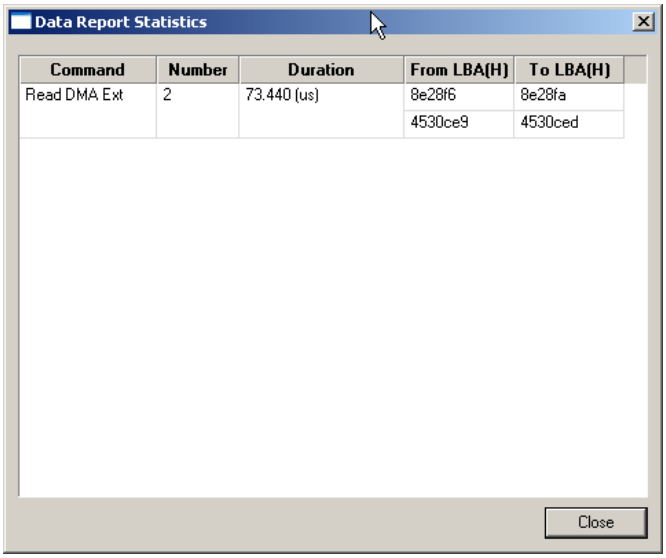


Figure 3.69: SAS: Data Report Statistics

Data Payload View

To display the Data Payload View, double-click a data payload field in a Packet or Spreadsheet view, or right-click a data payload field and select **Open as Data View**:

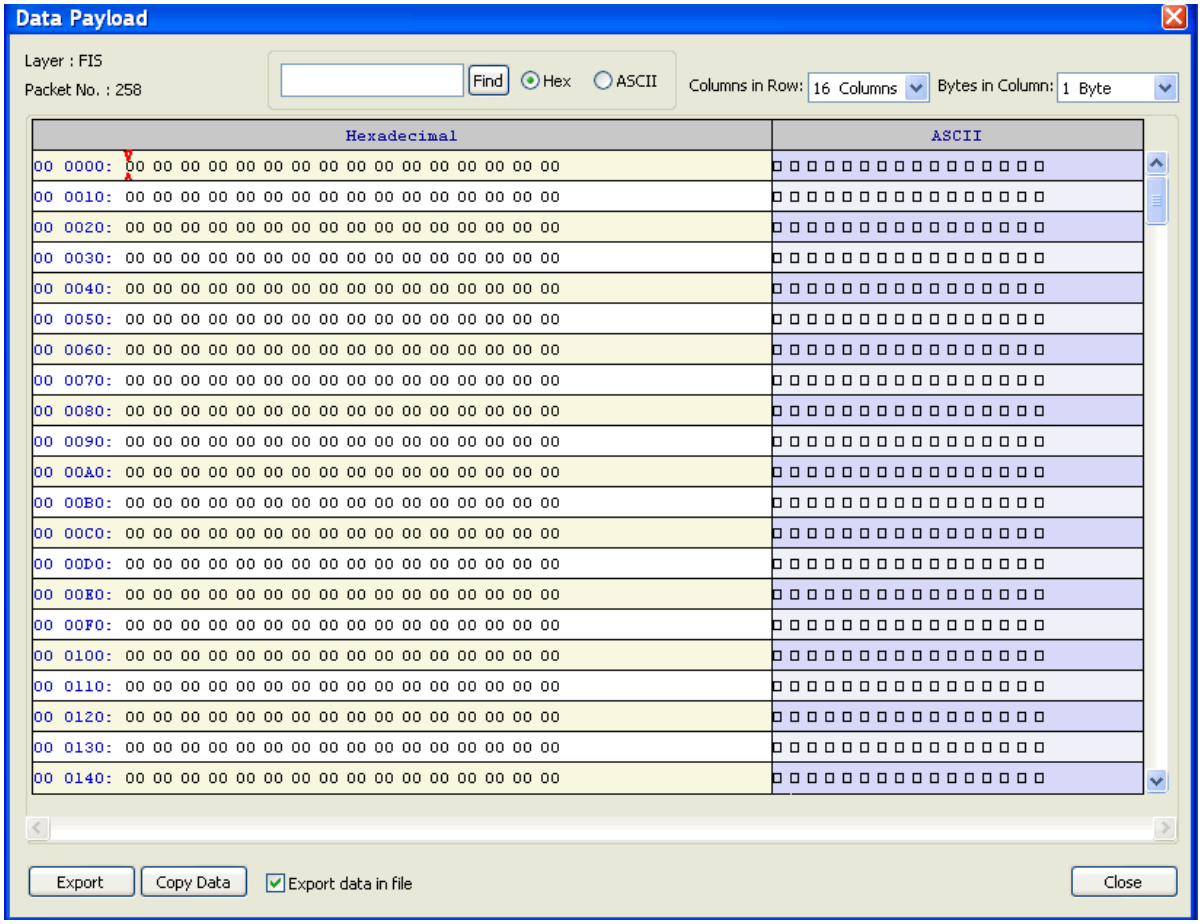


Figure 3.70: Data Payload View

Note: When showing truncated data in the Data Payload View, the truncation points are marked with a separator placed between payloads. You can get more information about the data exclusion using the tooltip over the separator.

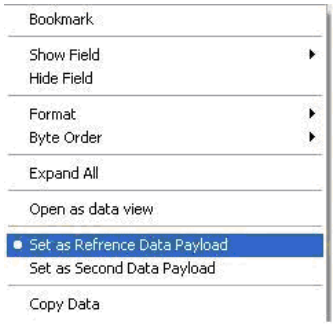
Note: You can control the number of bytes per line.

Find Data Pattern

To quickly locate a data pattern in the current frame, enter the pattern in the Text Box and click the **Find** button.

Compare Two Data Payloads

To compare two data payloads, select two different payload packets, one as reference. Right-click a payload field in Packet View or a related frame in Text View or Spreadsheet View to display a menu, then select **Set As Reference Data Payload**.



Right-click a payload field in Packet View or a related frame in Text View or Spreadsheet View to display a menu, and choose **Set as Second Data Payload**.

To compare data payloads, click the **Show/Hide Compare 2 Data Payloads** button on the View Type toolbar:

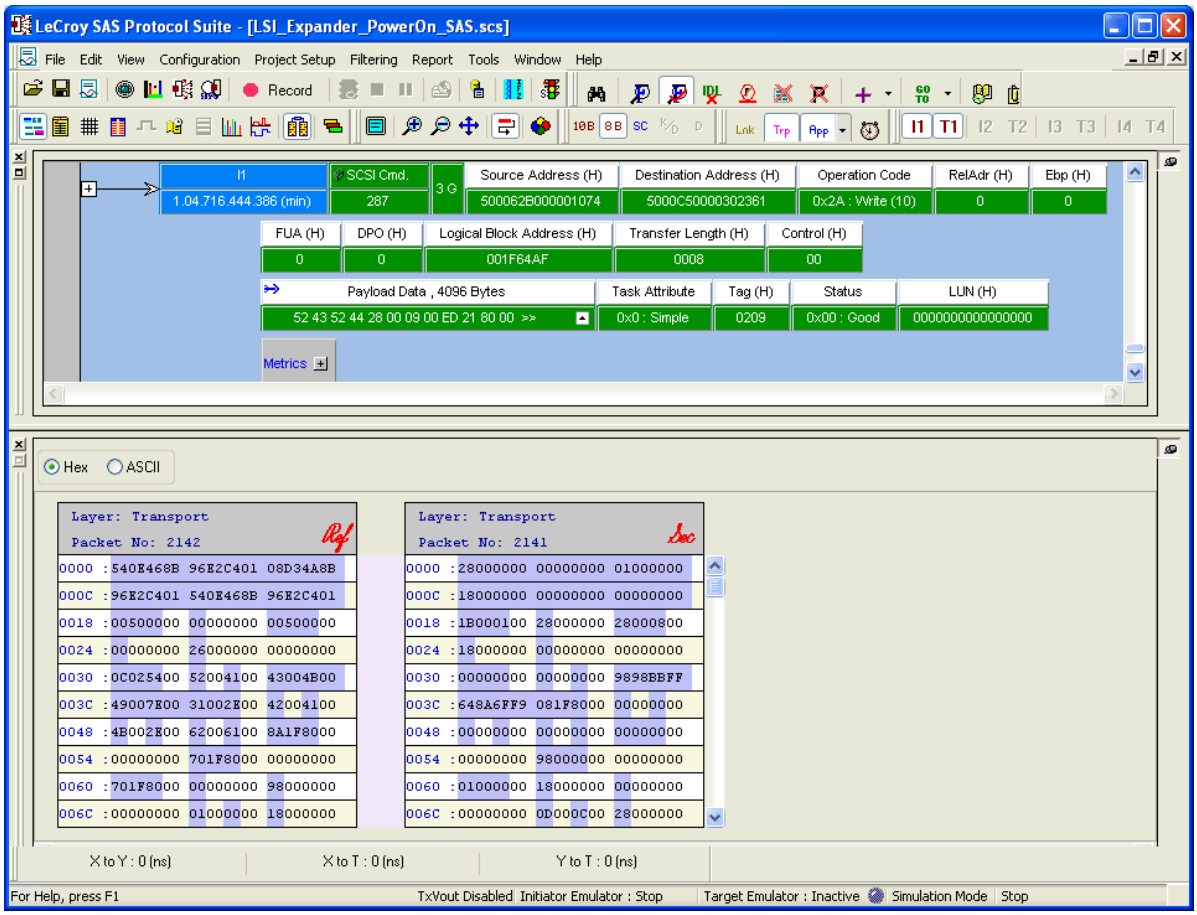

LeCroy SAS Protocol Suite - [LSI_Expander_PowerOn_SAS.scs]
File Edit View Configuration Project Setup Filtering Report Tools Window Help
Record
I1 1.04.716.444.386 (min)
SCSI Cmd. 287
Source Address (H) 500062B000001074
Destination Address (H) 5000C50000302361
Operation Code 0x2A : Write (10)
RelAdr (H) 0
Ebp (H) 0
FUA (H) 0
DPO (H) 0
Logical Block Address (H) 001F64AF
Transfer Length (H) 0008
Control (H) 00
Payload Data , 4096 Bytes 52 43 52 44 28 00 09 00 ED 21 80 00 >>
Task Attribute 0x0 : Simple
Tag (H) 0209
Status 0x00 : Good
LUN (H) 0000000000000000
Metrics
Hex ASCII
Layer: Transport Packet No: 2142
Layer: Transport Packet No: 2141
X to Y : 0 (ns)
X to T : 0 (ns)
Y to T : 0 (ns)
For Help, press F1
TxVout Disabled Initiator Emulator : Stop
Target Emulator : Inactive
Simulation Mode
Stop

Figure 3.71: Compare Two Data Payloads

Running Verification Script Engine (VSE)

You can perform custom post-process analysis of the open trace by running a verification script over the trace. A verification script instructs the application to send trace and analysis information to the script. A verification script also contains script code, written using CATC Script Language (CSL) (see the **CSL_RefManual.pdf** document in the **docs** directory of the installation), used to process trace data and output that data in different formats.

Note: You may write your own verification scripts to perform custom verification and analysis. For information on how to write a verification script, see the *Verification Script Engine Reference Manual*.

To run a verification script over a trace:

1. Select the main menu item **Tools > Verification script** or click the

   Running verification scripts button on the main tool bar. The Run Verification Scripts dialog opens, from which you choose and then run one or several verification scripts:

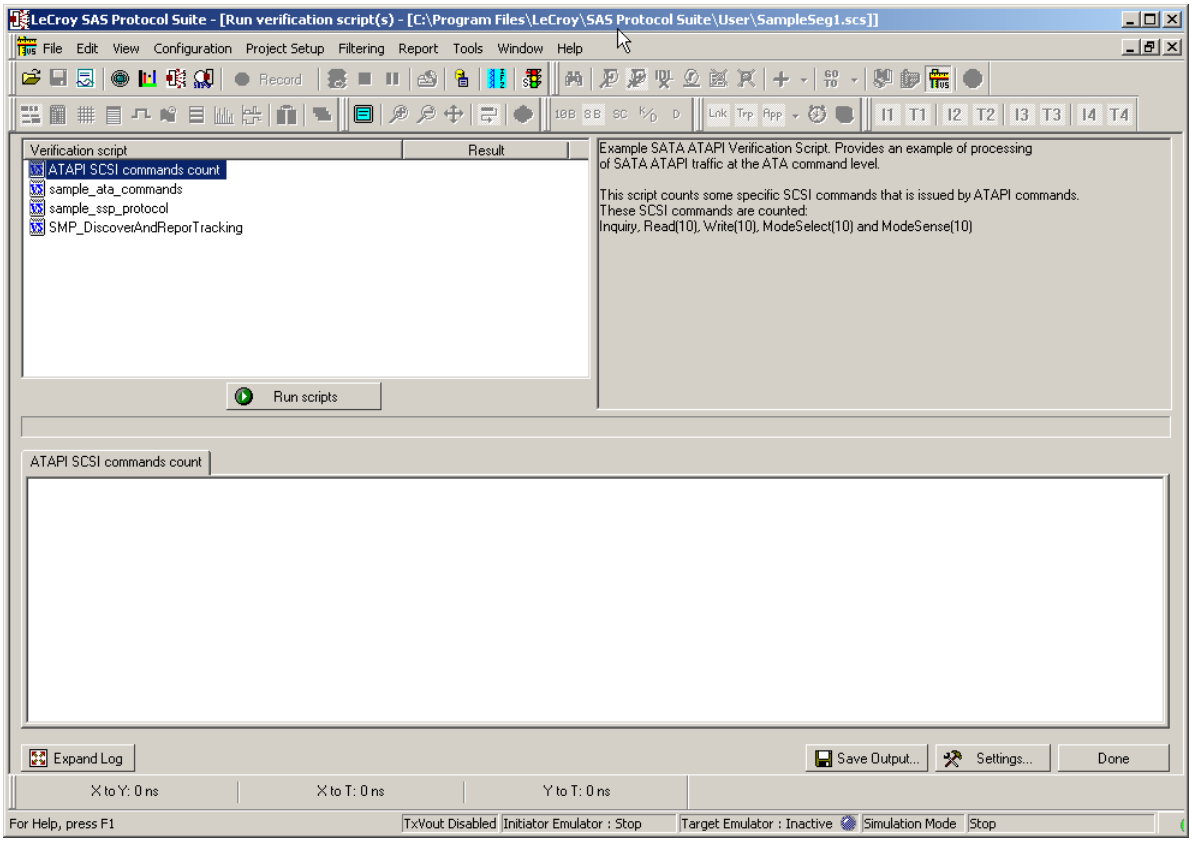

LeCroy SAS Protocol Suite - [Run verification script(s) - [C:\Program Files\LeCroy\SAS Protocol Suite\User\SampleSeq1.scs]]
File Edit View Configuration Project Setup Filtering Report Tools Window Help
Record
I1 T1 I2 T2 I3 T3 I4 T4
Verification script
Result
ATAPI SCSI commands count
sample_ata_commands
sample_ssp_protocol
SMP_DiscoverAndReporTracking
Example SATA ATAPI Verification Script. Provides an example of processing of SATA ATAPI traffic at the ATA command level.
This script counts some specific SCSI commands that is issued by ATAPI commands.
These SCSI commands are counted:
Inquiry, Read(10), Write(10), ModeSelect(10) and ModeSense(10)
Run scripts
ATAPI SCSI commands count
Expand Log
Save Output...
Settings...
Done
X to Y: 0 ns
X to T: 0 ns
Y to T: 0 ns
For Help, press F1
TxVout Disabled
Initiator Emulator : Stop
Target Emulator : Inactive
Simulation Mode
Stop

Figure 3.72: Run Verification Scripts Dialog

To expand the Log window, click the **Expand Log** button. The Log window fills the whole window. To see the Verification Scripts window again, click the Collapse Log button.

To save output, click the **Save Output** button.

2. After choosing **Settings** from the drop-down list or the button, the Settings dialog appears:

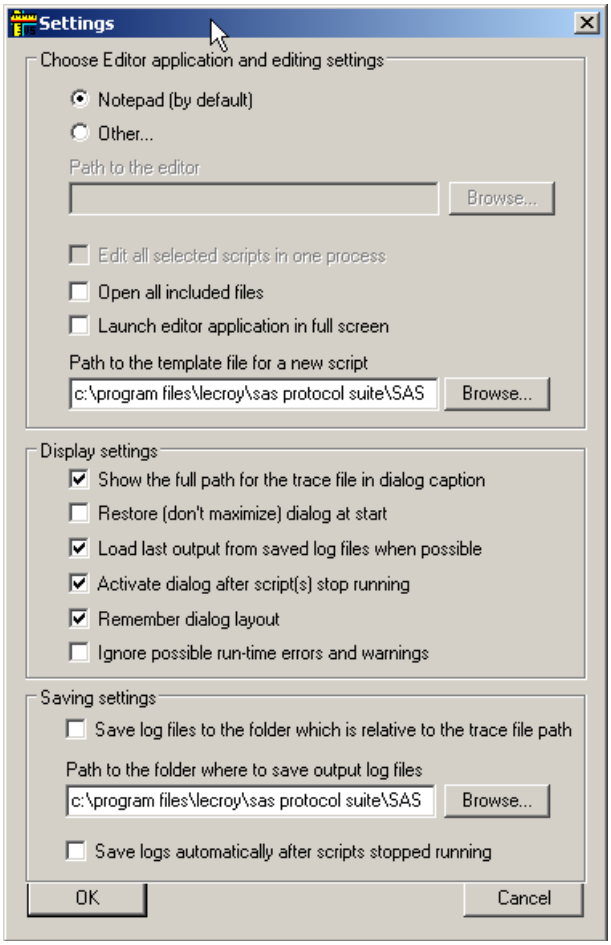

Settings
Choose Editor application and editing settings
Notepad (by default)
Other...
Path to the editor
Browse...
Edit all selected scripts in one process
Open all included files
Launch editor application in full screen
Path to the template file for a new script
c:\program files\lecroy\sas protocol suite\SAS
Browse...
Display settings
Show the full path for the trace file in dialog caption
Restore (don't maximize) dialog at start
Load last output from saved log files when possible
Activate dialog after script(s) stop running
Remember dialog layout
Ignore possible run-time errors and warnings
Saving settings
Save log files to the folder which is relative to the trace file path
Path to the folder where to save output log files
c:\program files\lecroy\sas protocol suite\SAS
Browse...
Save logs automatically after scripts stopped running
OK
Cancel

Figure 3.73: Run Verification Scripts - Settings Dialog

Choose the editor application: Notepad or other.

Edit all selected scripts in one process: If the editor supports multiple documents, you can edit all scripts in the editor.

Open all included files: You can edit included files, as well as the main script.

Launch editor application in full screen: You can use whole screen.

Path to the template file for a new script: You can use a template for the script.

Display Settings can show full trace-file path, restore dialog at start, load last output from save log files, activate dialog after scripts have run, remember dialog layout, and ignore errors and warnings.

Saving Settings can save log files to relative file folder, indicate output-log-file path, and save logs automatically.

3. Click the **Run scripts** button after you select scripts to run. VSE starts running the selected verification scripts, shows script report information in the output windows, and presents the results of verifications in the script list:

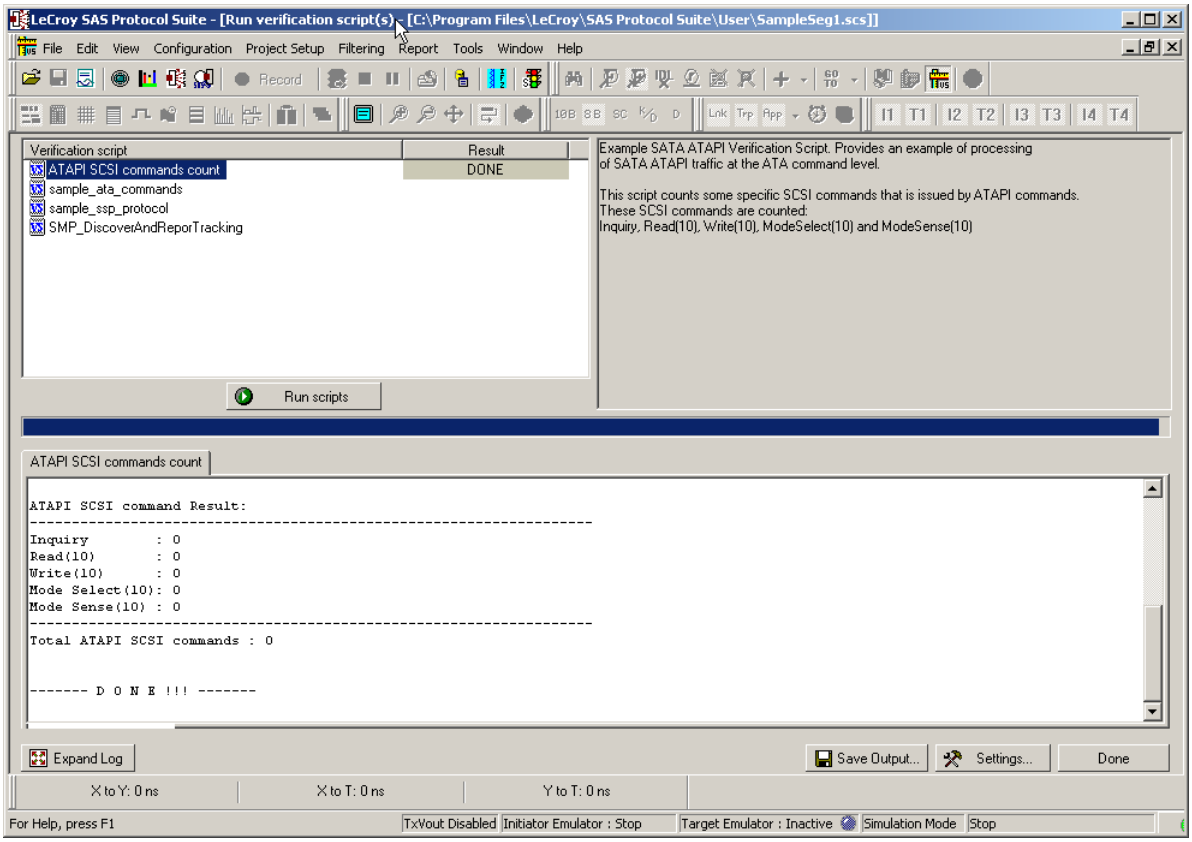

LeCroy SAS Protocol Suite - [Run verification script(s) - [C:\Program Files\LeCroy\SAS Protocol Suite\User\SampleSeq1.scs]]
File Edit View Configuration Project Setup Filtering Report Tools Window Help
Record
Verification script
Result
ATAPI SCSI commands count
DONE
sample_ata_commands
sample_ssp_protocol
SMP_DiscoverAndReporTracking
Example SATA ATAPI Verification Script. Provides an example of processing of SATA ATAPI traffic at the ATA command level.
This script counts some specific SCSI commands that is issued by ATAPI commands.
These SCSI commands are counted:
Inquiry, Read(10), Write(10), ModeSelect(10) and ModeSense(10)
Run scripts
ATAPI SCSI commands count
ATAPI SCSI command Result:
Inquiry : 0
Read(10) : 0
Write(10) : 0
Mode Select(10): 0
Mode Sense(10) : 0
Total ATAPI SCSI commands : 0
------- D O N E !!! -------
Expand Log
Save Output...
Settings...
Done
X to Y: 0 ns
X to T: 0 ns
Y to T: 0 ns
For Help, press F1
TxVout Disabled
Initiator Emulator : Stop
Target Emulator : Inactive
Simulation Mode
Stop

Figure 3.74: Run Verification Scripts Dialog

4. Right-clicking in the script list displays some additional operations over selected scripts:

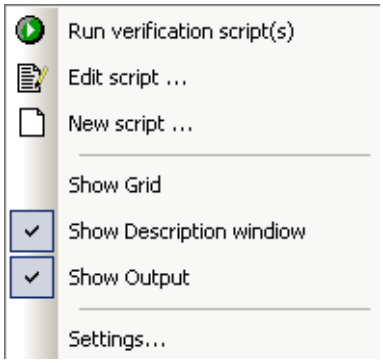


Figure 3.75: Run Verification Scripts - Menu

Run verification script(s): Start running selected script(s).

Edit script: Edit selected scripts in the editor application specified in Editor settings.

New script: Create a new script file using the template specified in Editor settings.

Show Grid: Show/hide a grid in the verification script list.

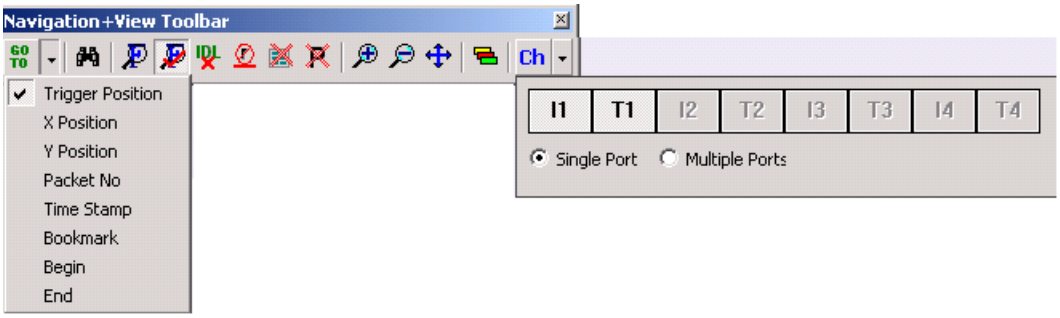
Show Description window: Show/hide the script description window (Shortcut key F2).

Show Output: Show/hide the script output windows (Shortcut key F3).

Settings: Open a special Setting dialog to specify different settings for VSE.

Navigation + View Toolbar

The Navigation + View toolbar allows you to navigate, search filter, hide RRDY/all primitives and unassociated traffic, zoom, tile views and select ports.



	The down arrow on the **Go To** button allows location of cursors or specific packets: Trigger Position, X Position, Y Position, Packet Number, Timestamp, Bookmark, Begin, and End.
	The **Search** button opens the search dialog (see “Search” on page 178).
	The **Filtering Setup** button opens the Filter dialog (see “Filtering” on page 167) and allows you to specify the criteria for filtering the result.
	The **Enable Disable Filtering** button toggles the result between a filtered and unfiltered view (see “Filtering” on page 167).
	The **Filter Idle** button toggles the display to show/hide idle packets (see “Filtering” on page 167).
	The **Hide RRDY Primitives** button toggles the display to show/hide RRDY primitives (see “Filtering” on page 167).
	The **Hide Unassociated Traffic** button toggles the display to show/hide unassociated traffic (see “Filtering” on page 167).

	The **Hide All Primitives** button toggles the display to show/hide all primitives (see "Filtering" on page 167. **Note:** When capturing PM traces, you need the ability to filter the PM primitives so you can find commands quicker.
	The **Zoom In** button on the Viewer Setting Toolbar magnifies the data display area on the screen. Clicking this button in Column or Text View increases column width only.
	The **Zoom Out** button on the Viewer Setting Toolbar scales the data display area to display more data lines on the screen. Clicking this button in Column or Text View decreases column width only.
	The **Normal Zoom** button on the Viewer Setting Toolbar resets the zoom to default normal on the screen. Clicking this button in Column or Text View resets column width only.
	You can use **Tile Horizontally All Views icon** or select **View > Tile Views** to revert any unintended window docking or sizing, or maximize screen utilization. This function only tiles views inside a trace window. Note that there is no command to tile views vertically.
	The **Data Report** button displays the data report.

Go To Menu

Locate Cursors

To quickly locate any cursor within the data viewer display, click the **Go To** button and choose the cursor to locate. You can also locate a cursor by selecting **Go To** from the Edit menu and choosing the cursor to locate.

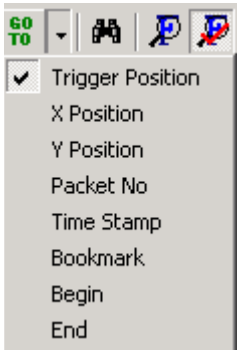


Figure 3.76: Locate Cursor

Go to Time Stamp

To locate a timestamp, click the **Go To** button and choose **Timestamp**.

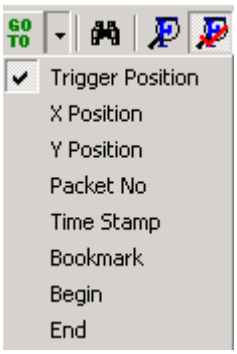


Figure 3.77: Time Stamp

Enter a time stamp value in the Go To Timestamp dialog and click **OK**.

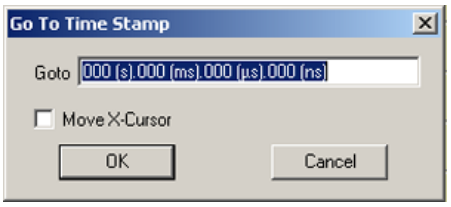


Figure 3.78: Go to Time Stamp

Bookmarks

Bookmarks are a convenient way to mark a point in the data viewer display by name, so that you can rapidly return to that point. To create a bookmark, right-click the mouse in the data viewer area on a packet in which to place the bookmark.

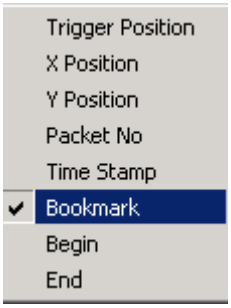


Figure 3.79: Bookmark

Click **Bookmark** from the fly out menu to open the Bookmark Comment Dialog.

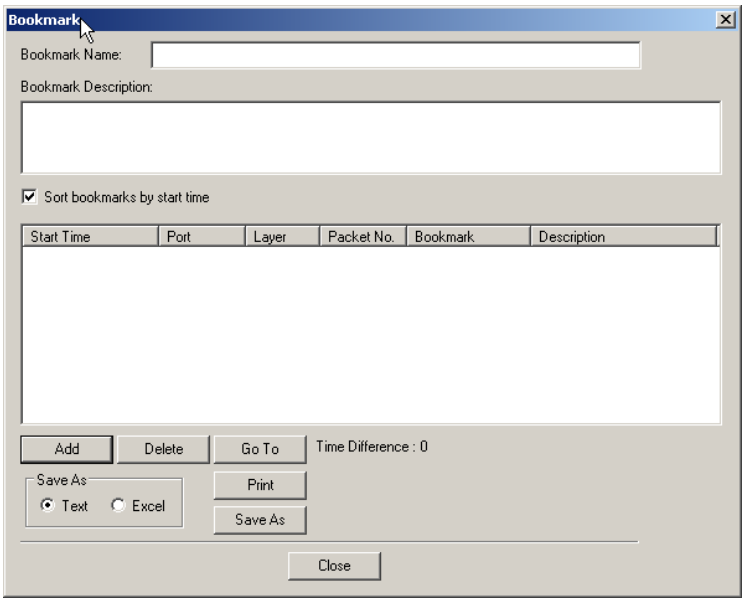


Figure 3.80: Bookmark Dialog

Enter a description for the bookmark and click the **Add** button. Repeat for additional **bookmarks.**

You can save the bookmark as a text file or Excel CSV file.

Note: Column View has a different bookmark mechanism than other views, and you can set a bookmark on each DWORD in the view. This makes Column View bookmarks unavailable in other views and vice versa.

Editing a Bookmark

If a packet has a bookmark, you can edit the bookmark by right-clicking the data viewer area of the packet, selecting the **Edit Bookmark** command from the pop-up menu, and changing the information in the Bookmark dialog (see above).

Finding a Bookmark

To find a bookmark in the data viewer display, right-click the mouse in the sample viewer and select **Bookmark.**

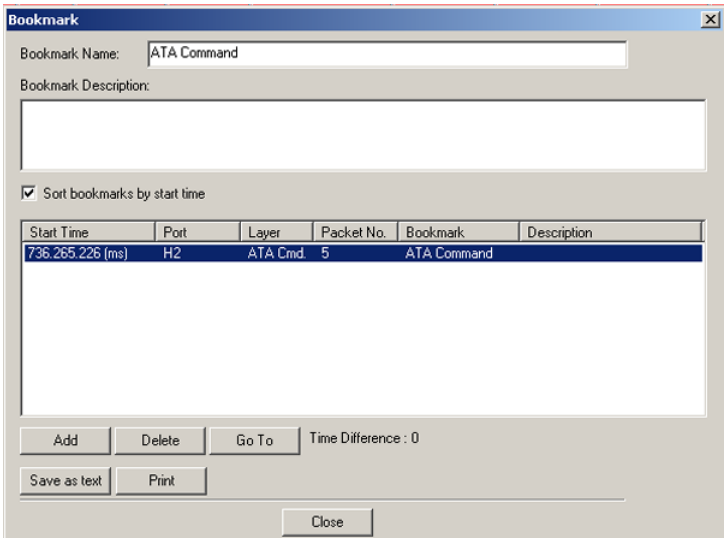


Figure 3.81: Go To Bookmark Dialog Box

Highlight the bookmark to which to go, then click the **Go To** button, or double-click the selection**.**

Figure 3.82: Bookmark Found Example in Data Viewer Display

Bookmark Description

To get a quick description of a displayed bookmark, position the tool tip over a bookmark. The name and description of the bookmark display.

Set Time Stamp Origin

Right-click in the sample viewer to open the fly out menu:

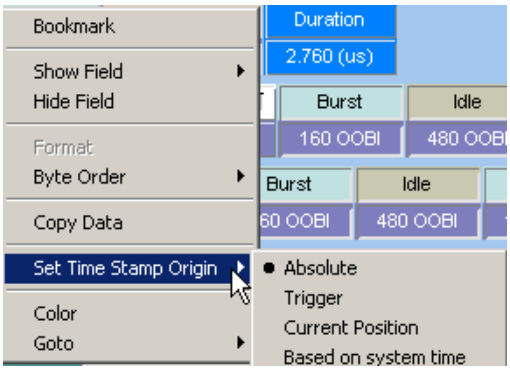


Figure 3.83: Bookmark Found Example in Data Viewer Display

Highlight **Set Time Stamp Origin** and choose either Absolute, Trigger, Current Position, or Based on system time.

Filtering

The Filtering menu and options allow you to modify data in the sample viewer display to exclude packets with a set of user-defined patterns and show the results in all views.

To set up filtering, you must have a viewer display open.

The Filtering menu has the options:

- Enable Filtering (see “Enable Filter” on page 177)
- Filtering (see “Filter Setup” on page 167)
- Link Layer (SAS)
- Transport Layer (SAS)
- Application Layer (SAS)
- Physical Layer (SATA)
- FIS Layer (SATA)
- Command Layer (SATA)
- Filter Idles (see “Filter Idle” on page 178)

Filter Setup

To display the Filter setup dialog, click the **Filter** button on the Viewer toolbar or select **Filtering (see** following screen capture).

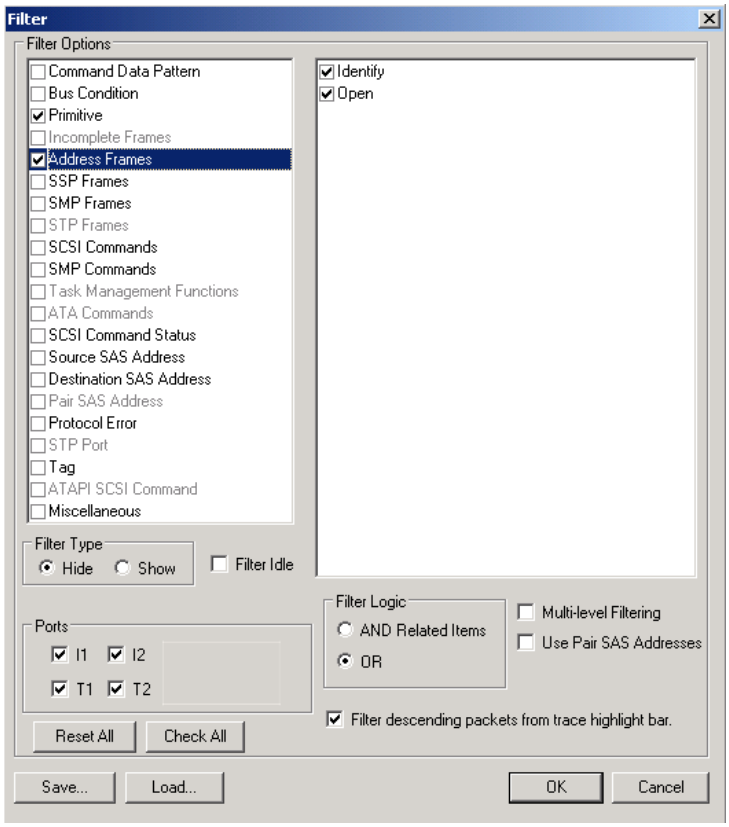


Figure 3.84: SAS: Filter Setup Dialog

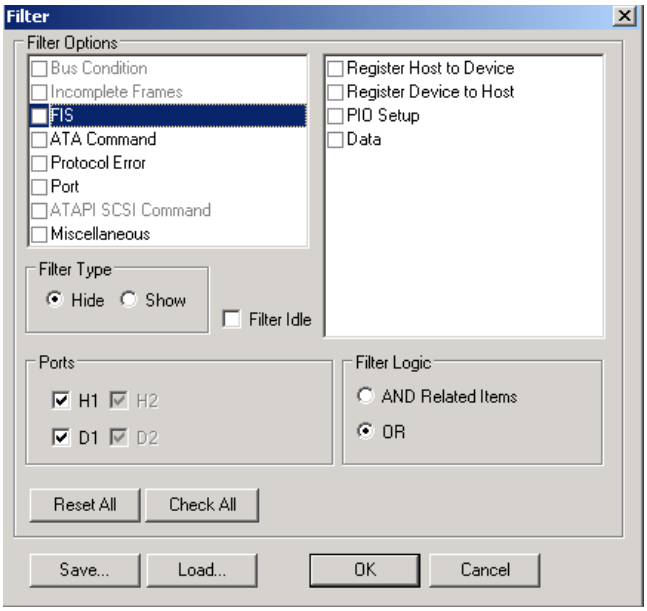


Figure 3.85: SATA: Filter Setup Dialog

You can select or deselect each of the items shown in the Filter Options window for filtering, by checking or unchecking a corresponding check box. Items not in the current sample are in shade.

Note: If you select a group, that also selects all child items.

Note: Only packets captured at run time are available for selection for filtering.

Filter Type

You can choose to show or hide the Filter Type items by checking the **Show** or **Hide** option button.

Note: When capturing PM traces, you need the ability to filter the PM primitives so you can find commands quicker.

Filtering Direction

You can select items for filtering in a single direction or both directions by checking the corresponding Port. By default, all ports are enabled. Uncheck the port check boxes for ports not to include in the filter.

Filter Idle

Depending on the Filter Type (Hide/Show), Idle packets in the Sample Viewer are shown or hidden.

Save Filter Setup

After you have set up a Filter configuration, you can save it as an SAS Filter file (***sfl**) or SATA Filter file (***.tfl**) by clicking **Save**. You can then use it on a different capture by clicking **Load** in the Filter dialog.

Filter Logic

After you have set up Filter options, you can set filter logic to **And Related Items** to apply "AND" logic on related selected options (for example, SCSI commands and SAS Addresses) or **OR** to apply "OR" logic on all selected options.

Multilevel Filtering in SAS

You can set up a filter in a sequential steps by **Multi level filtering**. In each level, you can select specific items to "AND" to the previous level. The results of all levels show in views (see following screen capture).

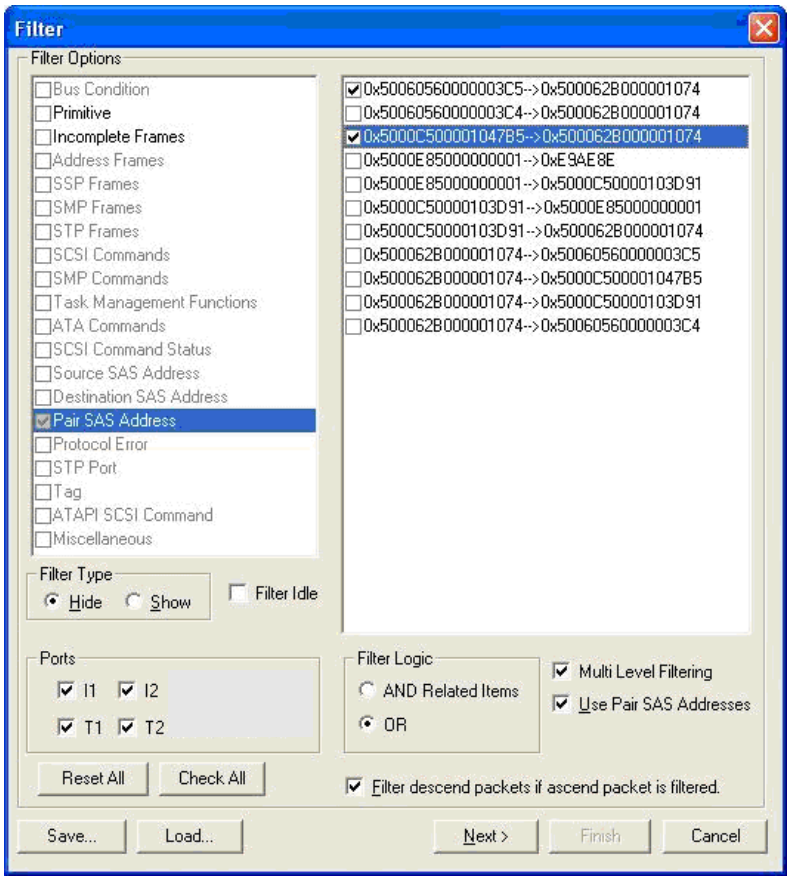


Figure 3.86: First Level of Multilevel Filtering

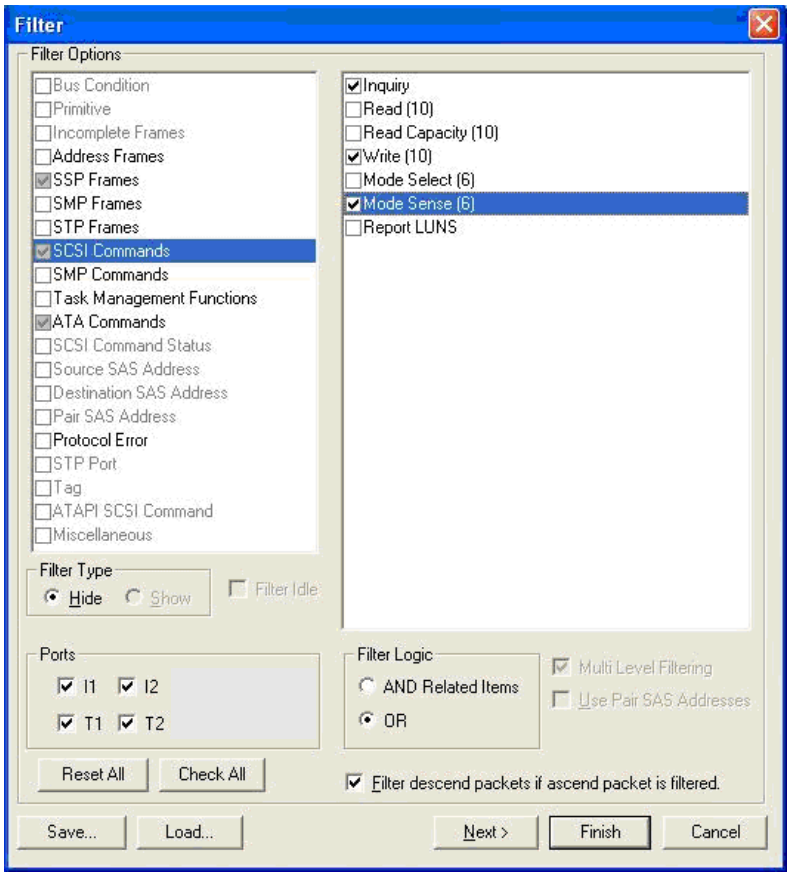


Figure 3.87: Second Level of Multilevel Filtering

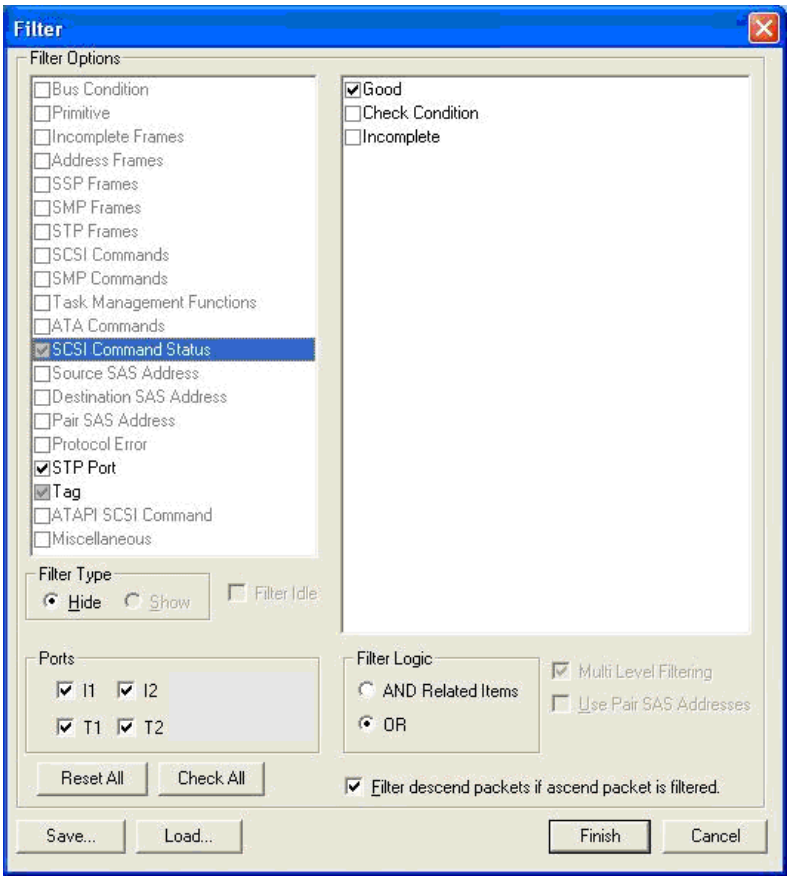


Figure 3.88: Third Level of Multilevel Filtering

Filter descending packets from trace highlight bar

If you check the **Filter descending packets from trace highlight bar** checkbox, the application will only filter onward from the highlighted trace selection bar.

If you uncheck this option, the software only filters the filtered packet. For example, if this option is checked and any SCSI command is selected, all transport and link packets of this command are filtered. If you unchecked this option, only selected SCSI commands are filtered.

Selectable Filter Options for SAS

- The SAS Filter Options are:
- Bus Condition
- Primitive
- Incomplete Frames
- Address Frames
- SSP Frames
- SMP Frames
- STP Frames
- SCSI Commands
- Task Management Functions

- ATA Commands
- SCSI Command Status (see “Filter Check Condition” on page 174)
- Source SAS Address
- Destination SAS Address
- Pair SAS Address
- Protocol Error
- STP Port
- Tag (see “Filter by Tag Number” on page 174)
- ATAPI SCSI Command
- Miscellaneous (see “Filter Miscellaneous” on page 175)

Bus Condition

When selected, depending on the Filter Type, the Hide/Show selection shows or hides captured Bus Conditions in the Sample Viewer.

Incomplete Frames

When selected, depending on the Filter Type, the Hide/Show selection shows or hides Incomplete Frames in the Sample Viewer.

ATA Command

When selected, depending on the Filter Type, the Hide/Show selection shows or hides captured ATA commands in the Sample Viewer.

Protocol Error

When selected, depending on the Filter Type, the Hide/Show selection shows or hides captured packets with the specified Protocol Errors in the Sample Viewer.

ATAPI SCSI Command

When selected, depending on the Filter Type, the Show/Hide selection shows or hides ATAPI SCSI commands.

Filter Check Condition

Checking the **SCSI Command Status** check box enables Check Condition for filtering.

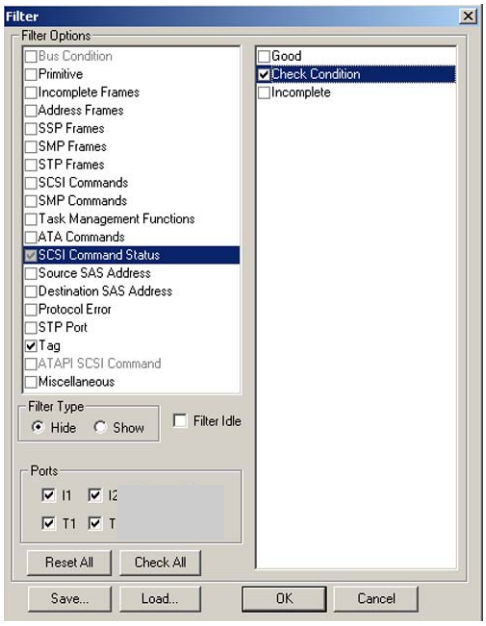


Figure 3.89: SAS: Filter Check Condition

Filter by Tag Number

Checking the **Tag** check box displays tags available for filtering. Check the corresponding check boxes for tags to filter.

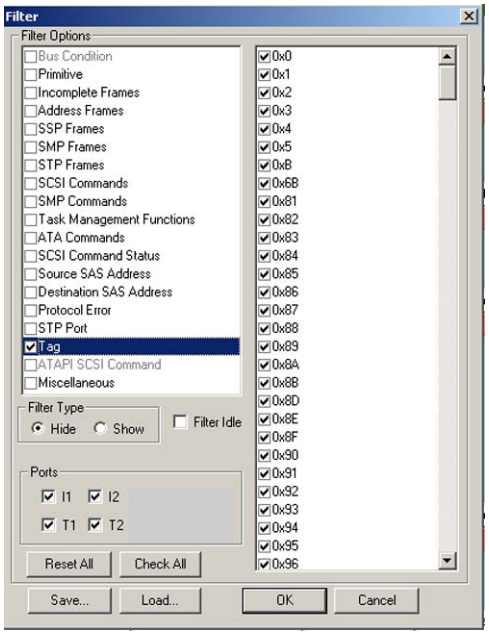


Figure 3.90: SAS: Filter by Tag Number

Filter Miscellaneous

When you choose **Miscellaneous**, an additional dialog displays, allowing you to specify the filtering of State Range and/or External Signal In.

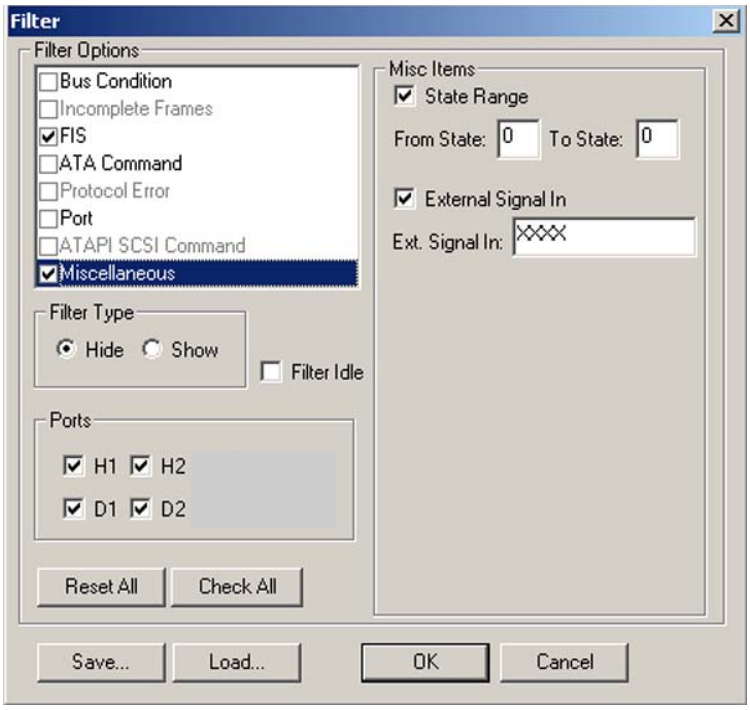


Figure 3.91: Filter State and/or External Signals

Use Pair SAS Addresses

You can use all available pair SAS addresses (Source -> Destination) instead of using SAS source and destination addresses. To enable the pair SAS address filter option, check **Use Pair SAS Addresses** check box in the Filter dialog.

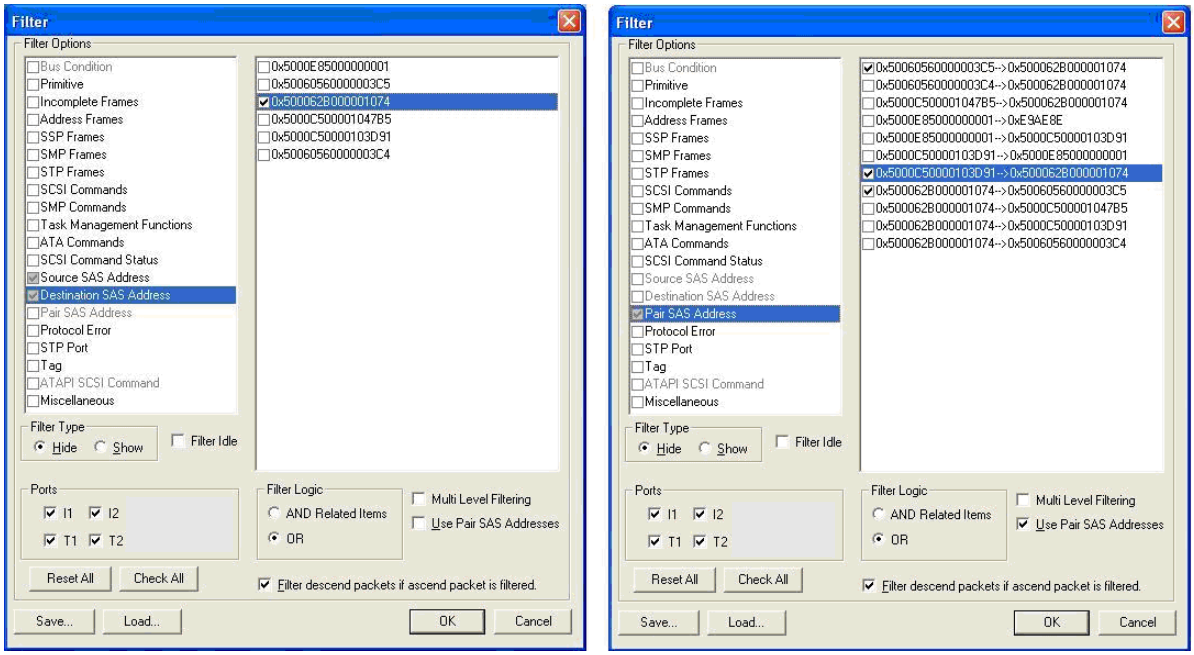


Figure 3.92: SAS: SAS Address Filtering before and after Using Pair SAS Addresses

Note: If you enable pair SAS addresses, the source/destination SAS addresses options are disabled and filtering on them is ignored at filtering time. If you disable pair SAS addresses, the pair SAS address option is disabled and filtering on it is ignored at filtering time.

Selectable Filter Options for SATA

The SATA filter options are:

- Bus Condition
- Incomplete Frames
- FIS
- ATA Command
- Protocol Error
- Port
- ATAPI SCSI Command
- Miscellaneous
- Filter Idle

Bus Condition

When selected, depending on the Filter Type, the Hide/Show selection shows or hides captured Bus Conditions in the Sample Viewer.

Incomplete Frames

When selected, depending on the Filter Type, the Hide/Show selection shows or hides Incomplete Frames in the Sample Viewer.

FIS

When selected, depending on the Filter Type, the Hide/Show selection shows or hides captured FIS items in the Sample Viewer.

ATA Command

When selected, depending on the Filter Type, the Hide/Show selection shows or hides captured ATA commands in the Sample Viewer.

Protocol Error

When selected, depending on the Filter Type, the Hide/Show selection shows or hides captured packets with the specified Protocol Errors in the Sample Viewer.

Port

When selected, depending on the Filter Type, the Show/Hide selection shows or hides packet traffic for the selected port.

ATAPI SCSI Command

When selected, depending on the Filter Type, the Show/Hide selection shows or hides ATAPI SCSI commands.

Miscellaneous

When you choose Miscellaneous, an additional dialog displays, allowing you to specify the filtering of State Range and/or External Signal In (see “Filter Miscellaneous” on page 175).

Enable Filter

Select **Filtering > Enable Filtering** or click the **Filter Enable** button on the display menu bar to toggle between Filtered and Unfiltered display.

Filter Idle

Depending on the Filter Type (Hide/Show), Idle packets in the Sample Viewer are shown or hidden.

You can quickly filter idles by clicking the

Filter Idle button. This button toggles between Show and Hide items.

Search

The Search menu and toolbar options permit you to examine any data capture file to quickly locate the packet or data pattern.

To perform an initial search, select **Edit > Search** or click the **Search** button to open the Search setup dialog (Figure 3.93).

Note: Only items captured in the sample file are enabled for search.

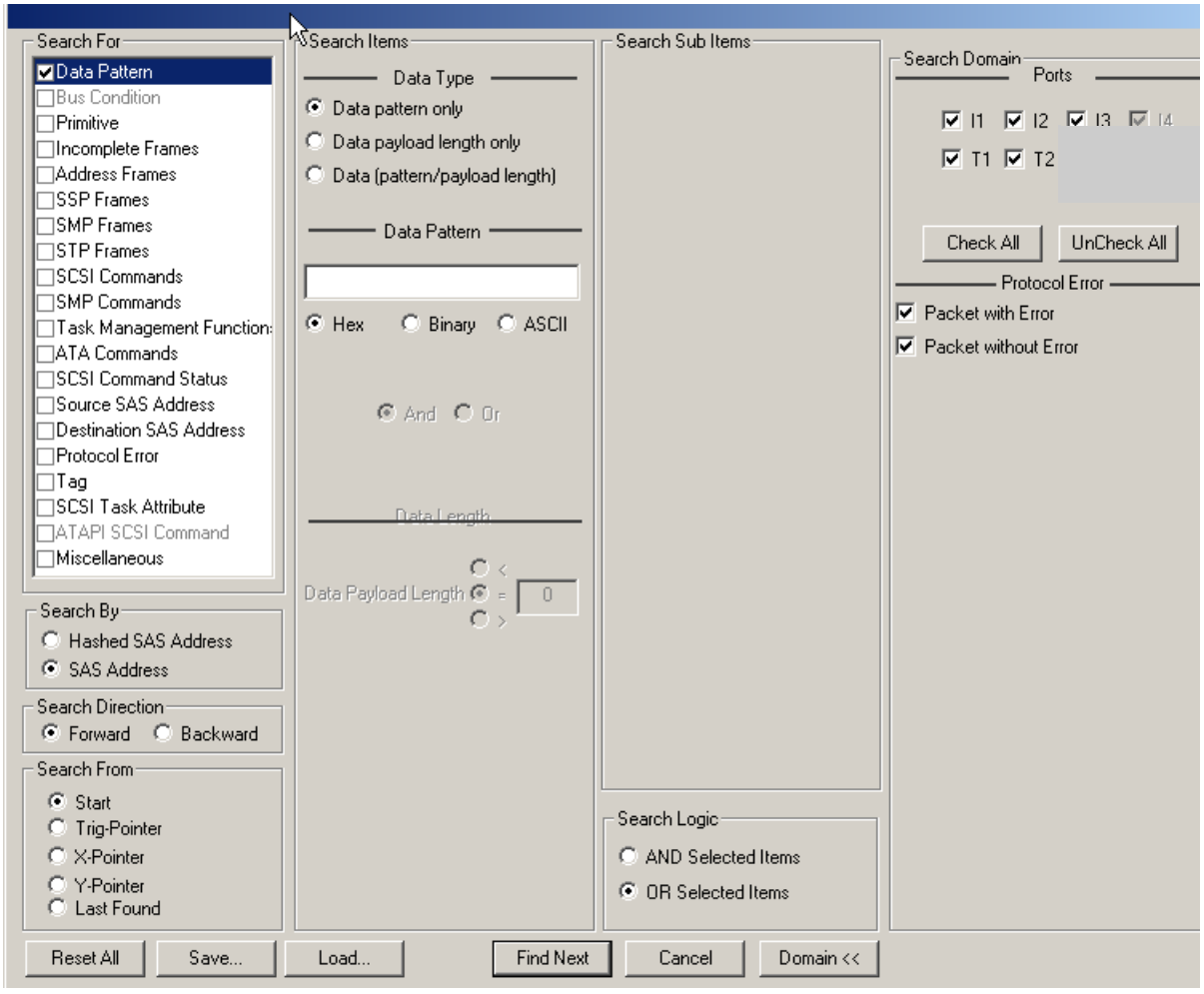


Figure 3.93: SAS: Search Data Pattern

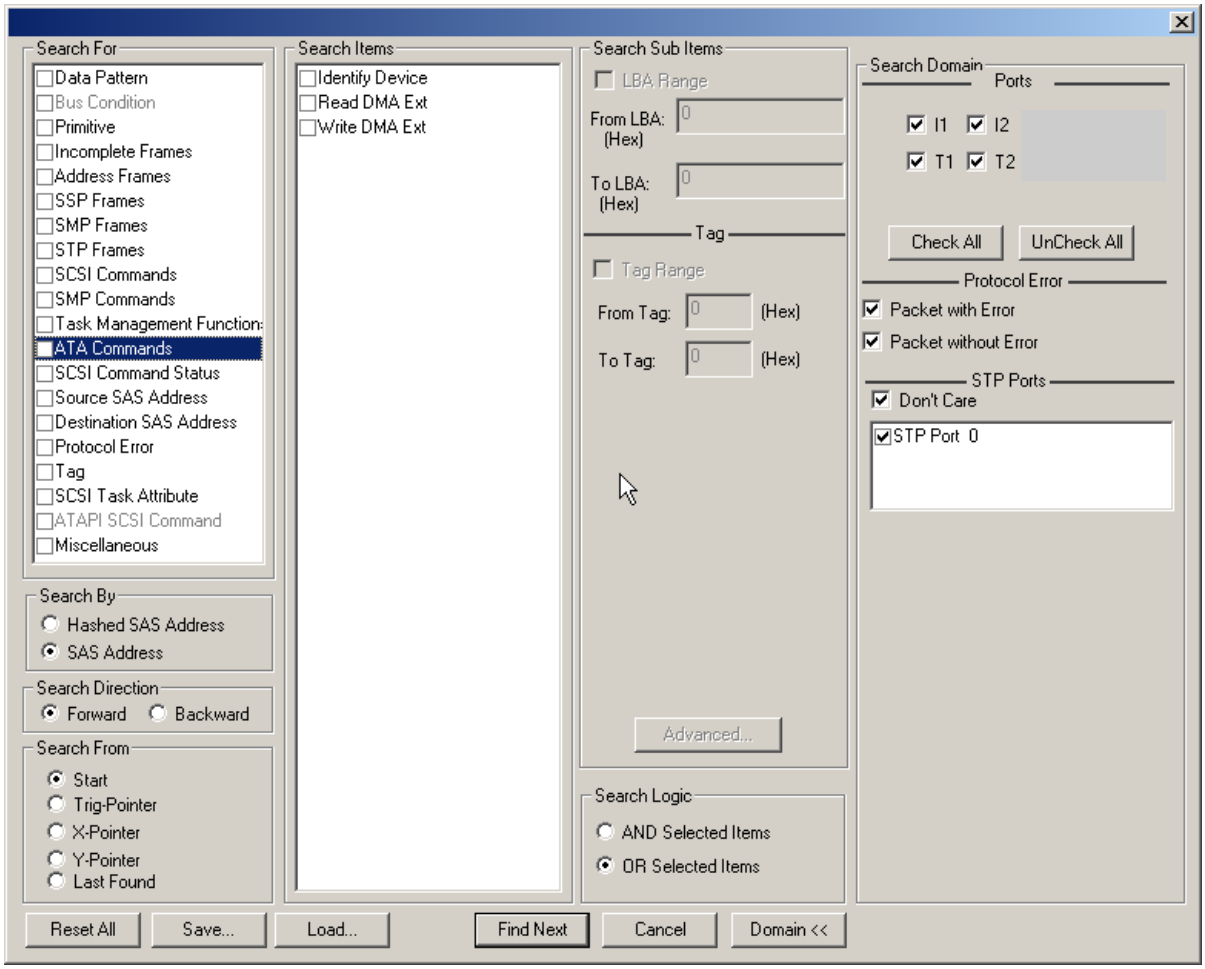


Figure 3.94: Search Parameter Definition Dialog

You can continue to search the output file using **Next Search (F3)** or **Previous Search (F4)** for the same pattern, until you redefine the data capture search parameters.

Save Search Setup

After you have set up a Search configuration, you can save it as a SAS Search configuration file (***.ssh**) or a SATA Search configuration file (***.tsh**) by clicking **Save**. You can then use it on a different capture by clicking **Load** in the Search dialog.

Search By

Choose **Hashed SAS Address** to search on hash address, or choose **SAS Address** to search for address.

Search Direction

Choose either **Forward** or **Backward** direction in which to perform the search.

Search From

Choose a starting point to begin or continue a search: Start of the sample file, Trigger Pointer, X Pointer, Y Pointer, or Last Found.

Search Logic

The default setting is **Or Selected Items**. With this setting, clicking **Find Next** locates all selected items in turn. If you choose **And Selected Items,** you can set a logical AND combination of items to find. Both options allow setting Advanced search features.

Search For

Choose a category to search in the **Search For** window. Each of the search categories offers additional choices in the **Search Items window** to refine the search. Check items for the selected category.

Data Pattern

Search for Data Pattern allows you to search for a specific Data Type, Pattern, and Length (see Figure 3.93 on page 178).

- Data Pattern Only
- Data Payload Length Only
- Data Pattern and Data Payload Length

Advanced options

Some of the Search For categories offer advanced options for search. To set these options, highlight the search item in a category and click the **Advanced** button to open the Advanced options dialog.

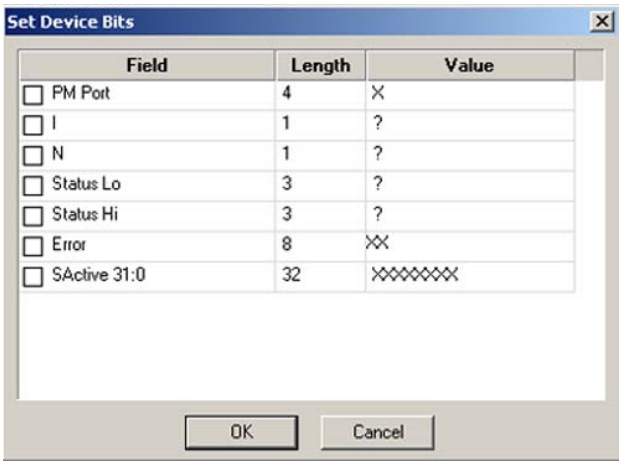


Figure 3.95: Advanced Options Dialog Example: Set Device Bits

Set the options and click **OK.**

Search Domain

Click the **Domain** button and choose a search domain from all ports or a specific port.

Protocol Error

You can refine the search to locate packets with an error or without an error.

Note: When searching for Protocol Errors in Column View, you cannot search for a specific Protocol Error type. Search returns any protocol error.

Search Sub Items

When searching SCSI Command Status, you can refine the search by selecting from a list of Sub Items.

Note: Some of the search categories allow you to refine the search by specifying specific SAS addresses and STP ports to search.

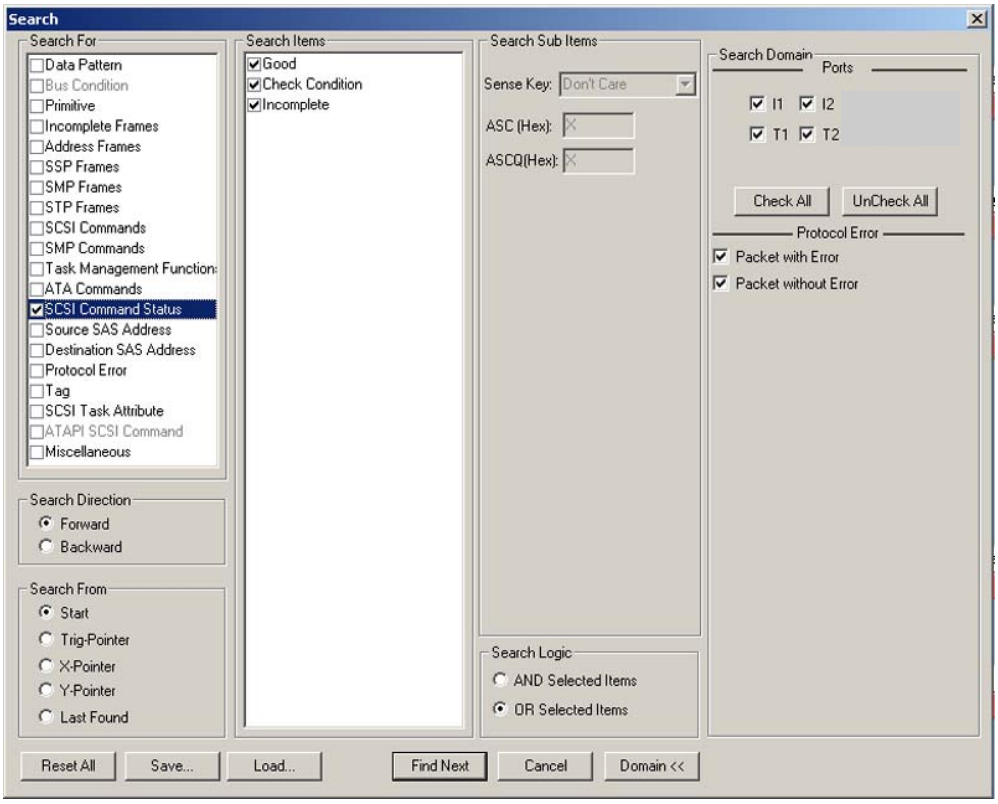


Figure 3.96: Search Sub Items

When you check the **SCSI Command Status,** the **Check Condition** item appears in the Search Items Window, if a check condition has occurred. Clicking this enables **Search Sub Items,** allowing you to refine the search by specifying **Sense Key, ASC,** and **ASCQ.**

Search by Tag Number

To search by Tag Number, check the **Tags** box in the Search For window and then check the Tag(s) for which to search in the Search Items window.

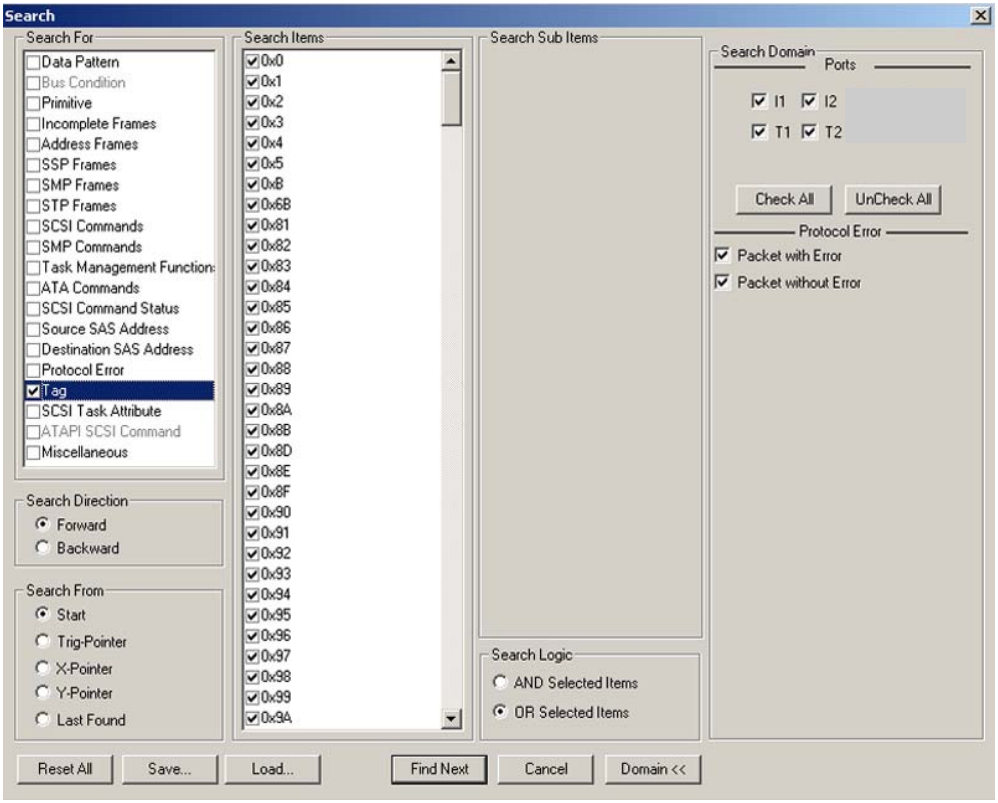


Figure 3.97: Search by Tag Number

Show/Hide Single Port

If Show/Hide Single Port is selected, you can click on one port button at a time to show/hide the capture for that port. Show/Hide Single Port is time consuming as it shows or hides one port at a time.

Show/Hide Multiple Ports

If Show/Hide Multiple Ports is selected, you can click on multiple ports to show or hide them. This mode is much faster. Click on multiple ports to show or hide them.

Figure 3.98: SAS: Show/Hide Ports Toolbar

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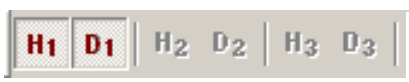
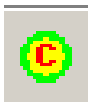
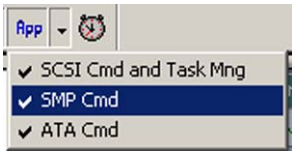


Figure 3.99: SATA: Show/Hide Ports Toolbar

You can also show or hide a port by right-clicking a **Port ID** in Text View or Column View and choosing **Show** or **Hide** (see Figure 3.103 on page 187).

Packet View Toolbar

The Packet View toolbar allows wrapping, zooming, and configuration.

	The **Wrap Packets** button on the Viewer Toolbar wraps the packet data in the display to eliminate the need for horizontal scrolling.
	Go to CATC Navigation View. Click this button to change the trace display to a CATC Trace™. You can change the colors, fonts, and so on, in the Trace Viewer Configuration (see "Set Port Alias" on page 200).
	The **Show/Hide Link Packet** button displays/hides the Link layer. SAS only.
	The **Show/Hide Transport Packet** button on the Layers Toolbar displays/hides the Transport layer and below. SAS only.
	The **Show/Hide All Commands Packet** button shows/hides the Command layer and all layers below: SCSI Cmd and Task Mng, SMP Cmd, and ATA Cmd. SAS only.
	Click the down arrow on the **Show/Hide All Commands Packet** button to choose command types to show/hide.
	The **Show/Hide Physical Packet** button toggles the display of physical layer packets. SATA only.
	The **Show/Hide FIS packet** button toggles the display of FIS layer packets. When "OFF", the FIS layer and its links are hidden. SATA only.
	The **Show/Hide CMD packet** button toggles the display of the CMD packets. When "ON", only the command layer displays. SATA only.

	The **Show/Hide Command Queue** button displays queued commands.
	The **Order/Reorder** toggles the time order of packets.
	The **Pack/Unpack Repeated Primitives** toggles packing repeated primitives in one port.
	The **10B** button displays the payload data as 10-bit encoded data.
	The **8B** button displays the payload as 8-bit scrambled or unscrambled data, depending on the Scrambled setting.
	The **SC** button selects scramble/unscramble for the 8-bit payload data.

CATC Navigation View

To change the trace display to a CATC Trace™, click the **CATC Navigation** button (see Figure 3.100 on page 185). You can change the colors, fonts, and so on, in the Trace Viewer Configuration (see “Trace Viewer Configuration” on page 195).

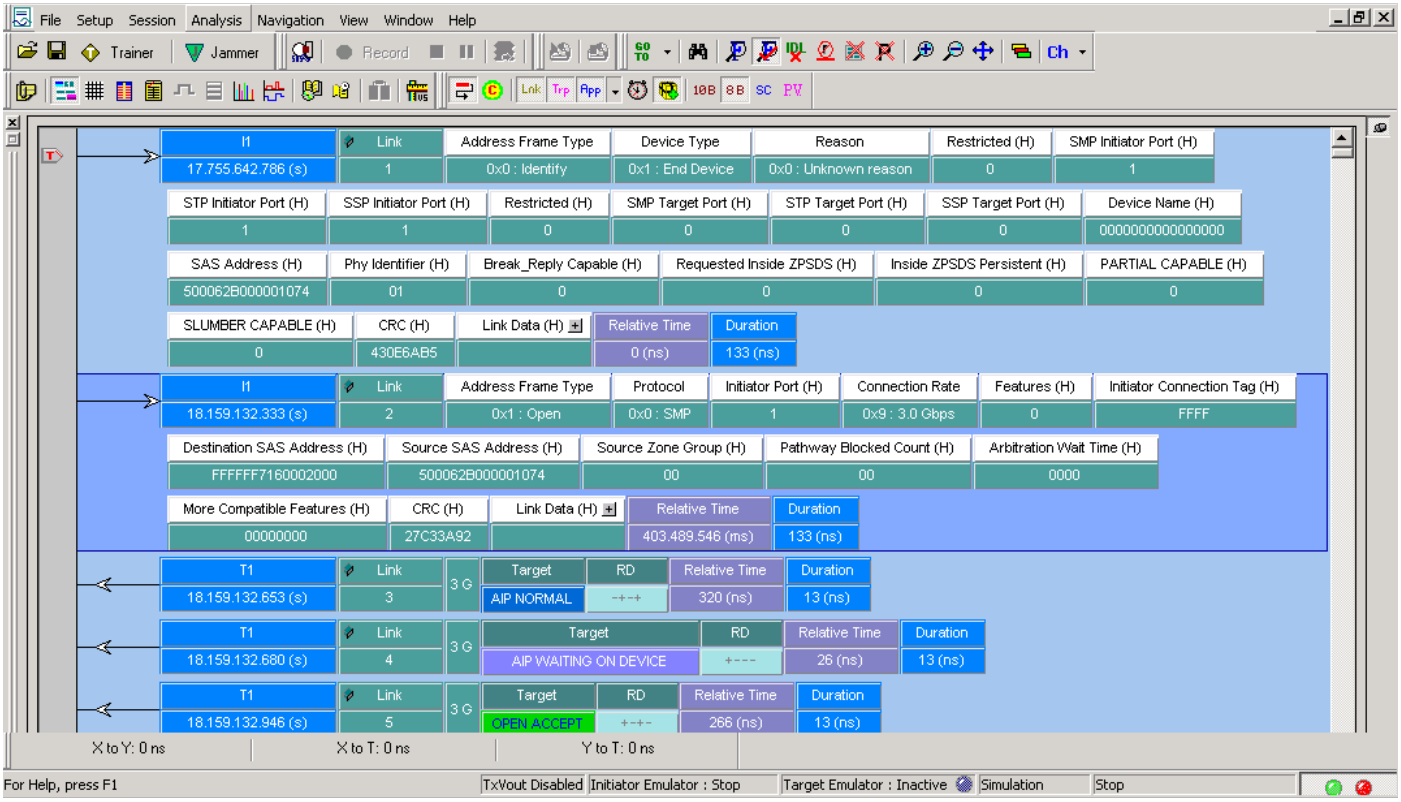

File Setup Session Analysis Navigation View Window Help
Trainer Jammer Record
I1 Link Address Frame Type Device Type Reason Restricted (H) SMP Initiator Port (H)
17.755.642.786 (s) 1 0x0 : Identify 0x1 : End Device 0x0 : Unknown reason 0 1
STP Initiator Port (H) SSP Initiator Port (H) Restricted (H) SMP Target Port (H) STP Target Port (H) SSP Target Port (H) Device Name (H)
1 1 0 0 0 0 0000000000000000
SAS Address (H) Phy Identifier (H) Break_Reply Capable (H) Requested Inside ZPSDS (H) Inside ZPSDS Persistent (H) PARTIAL CAPABLE (H)
500062B000001074 01 0 0 0 0
SLUMBER CAPABLE (H) CRC (H) Link Data (H) Relative Time Duration
0 430E6AB5 0 (ns) 133 (ns)
I1 Link Address Frame Type Protocol Initiator Port (H) Connection Rate Features (H) Initiator Connection Tag (H)
18.159.132.333 (s) 2 0x1 : Open 0x0 : SMP 1 0x9 : 3.0 Gbps 0 FFFF
Destination SAS Address (H) Source SAS Address (H) Source Zone Group (H) Pathway Blocked Count (H) Arbitration Wait Time (H)
FFFFFF7160002000 500062B000001074 00 00 0000
More Compatible Features (H) CRC (H) Link Data (H) Relative Time Duration
00000000 27C33A92 403.489.546 (ms) 133 (ns)
T1 Link 3 G Target RD Relative Time Duration
18.159.132.653 (s) 3 AIP NORMAL -++- 320 (ns) 13 (ns)
T1 Link 3 G Target RD Relative Time Duration
18.159.132.680 (s) 4 AIP WAITING ON DEVICE +--- 26 (ns) 13 (ns)
T1 Link 3 G Target RD Relative Time Duration
18.159.132.946 (s) 5 OPEN ACCEPT +--- 266 (ns) 13 (ns)
X to Y: 0 ns X to T: 0 ns Y to T: 0 ns
For Help, press F1 TxVout Disabled Initiator Emulator : Stop Target Emulator : Inactive Simulation Stop

Figure 3.100: CATC Navigation View

Spec View

Spec View shows packet header information.

To obtain the Spec View from the CATC View, left-click to display a popup menu, then select the **View Field** option.

To obtain the Spec View from the Catalyst View, right-click to display a popup menu, then select the **View Field** option.

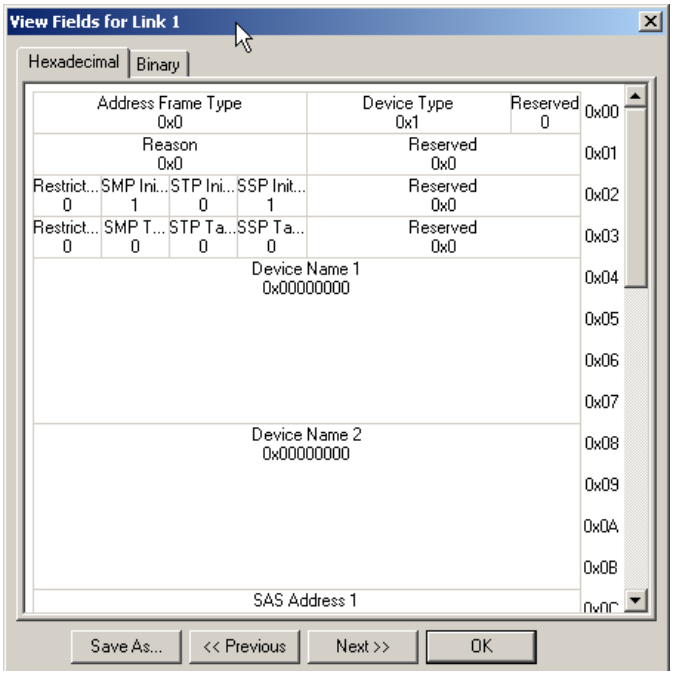


Figure 3.101: Spec View

The tabs allows you to display **Hexadecimal** or **Binary**.

The buttons allow you to go to **Previous** or **Next**.

You can **Save As** a text file.

Decode Icons

The **Decode Toolbar** controls encoding and scrambling features.

To view corresponding Unscrambled and Scrambled payload data values instantaneously, position the mouse pointer over a data field.

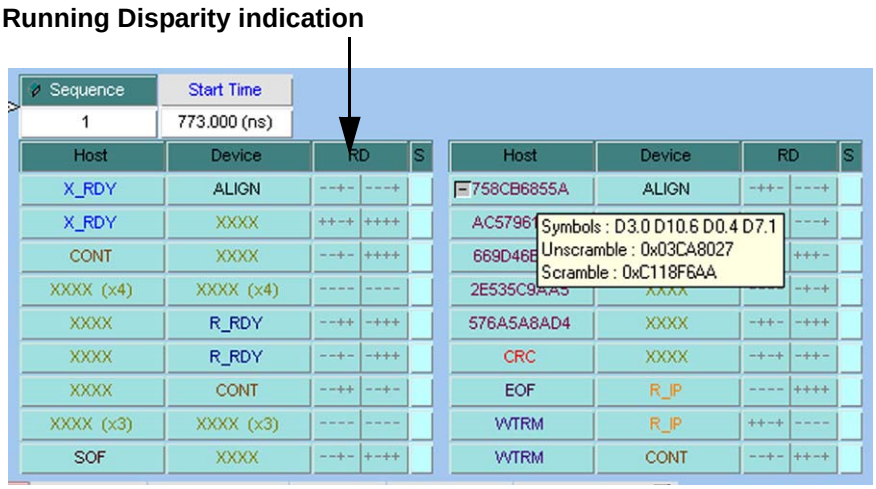


Figure 3.102: Payload Data Display

Customize Display

Rename Port

You can rename each port for easy identification. To rename a port, right-click the **port ID** in Text View or Column View.

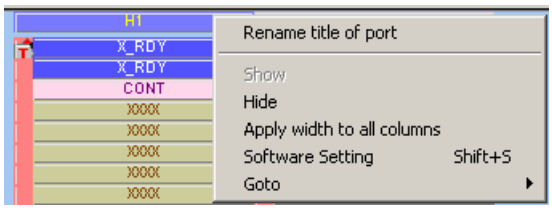


Figure 3.103: Rename Port

Choose **Rename title of port** to open the Rename Title of Port dialog.

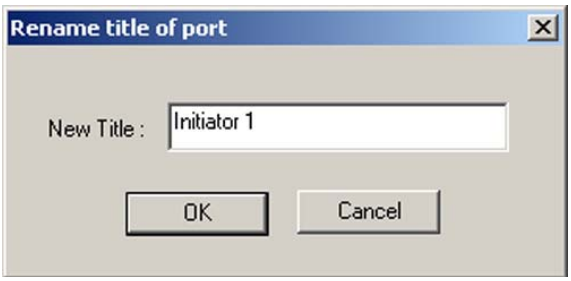


Figure 3.104: Rename Title of Port

Select and Apply Show/Hide Port Mode

You can simplify the viewer display by hiding the captures of ports. All active ports are highlighted on the Show/Hide Ports toolbar.

You can **Show/Hide a Single Port** or you can **Show/Hide Multiple Ports**. Click on the drop-down arrow and select from the two options as shown in the following figure:

- Show/Hide Single Port
- Show/Hide Multiple Ports

Click on the **Apply show/hide port** button to apply the specific mode.

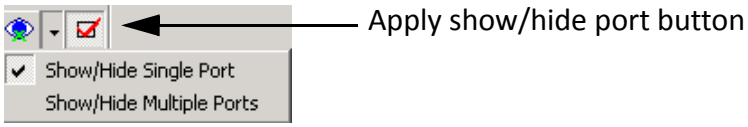


Figure 3.105: Show/Hide Single or Multiple Ports

Show/Hide Field

You can simplify the Viewer display by hiding some fields. You can hide the **Duration**, **Relative Time**, **External Signals,** and **Packet number** fields by right-clicking the corresponding field title and choosing **Hide Field**.

Figure 3.106: Hide Field

To restore a field to the display, right-click a **Port ID** field and choose the hidden field to restore.

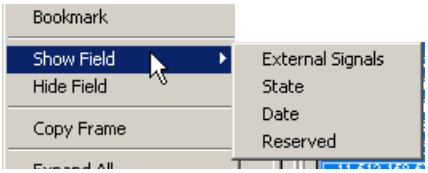


Figure 3.107: Show Field

Note: Only the fields previously hidden appear in the restore list.

Related Frames

Right-click a **Command frame** for an SSP frame, or **Register Device to Host** for an STP frame, to open a short-cut menu, then choose **Goto Response** to jump to the corresponding Response frame in the viewer.

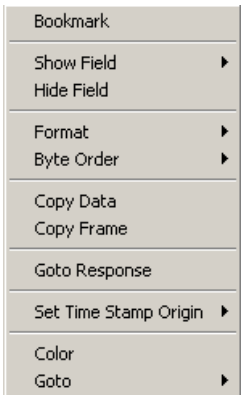


Figure 3.108: Goto Response

Similarly, right-click a **Response frame** for an SSP Frame, or **Register Device to Host** for an STP frame, to open a short-cut menu, then choose **Goto Command** to jump to the corresponding Command frame in the viewer.

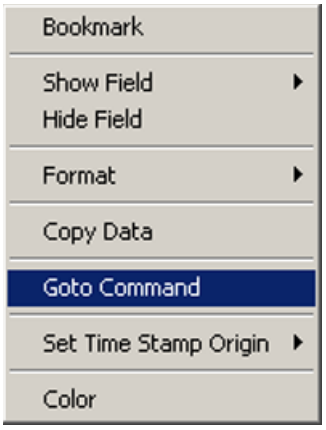


Figure 3.109: Goto Command

In Column View, you can right-click a **DWORD** inside a frame to display the **Goto Within Packet** command. You can jump to an SOF, EOF, HOLD, or R_IP.

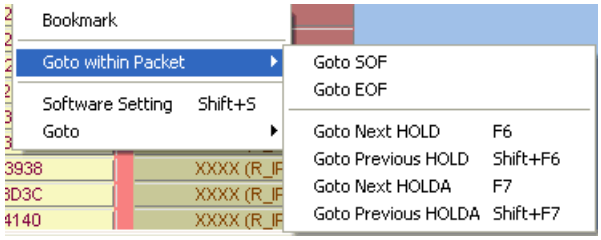


Figure 3.110: Goto Within Packet Command

Byte Order

You can change the byte order in fields marked by an arrow and other fields.

Right-click in the field, select **Byte Order,** and choose the ordering.

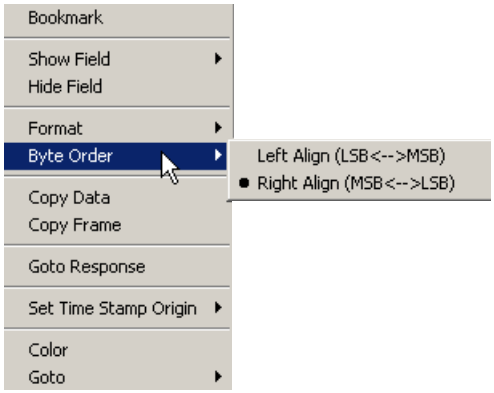


Figure 3.111: Byte Order

Note: A blue arrow in the byte order field indicates that it has been changed.

Choose Data Format

You can display data values either in hexadecimal (default) or binary. To choose data format, right-click the mouse over a data field, and choose **Format** and the format.

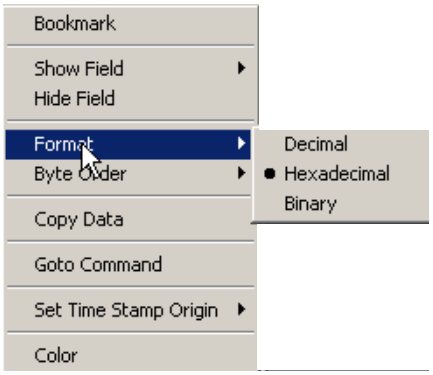


Figure 3.112: Format

Show All Data

To display all captured data, click the **data expand** toggle arrow in a data field, to examine the data in detail.

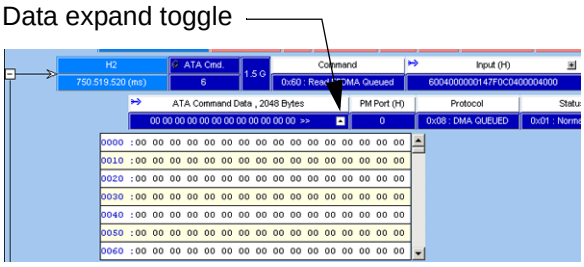


Figure 3.113: Show All Data

You can expand or collapse all data fields globally. To expand all data fields, right-click the mouse in a data field and choose **Expand All** (see Figure 3.114).

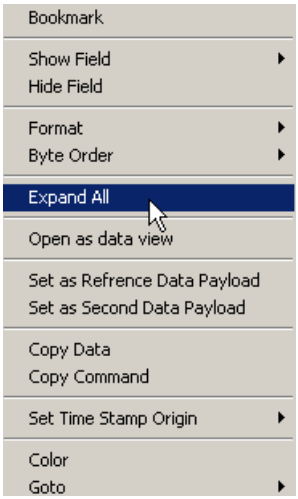


Figure 3.114: Expand All

To collapse all fields, right-click the mouse in a data field and choose Collapse All.

Port Status

You can get an overview of the active ports by clicking the **Port Status** button at the bottom right of the application window.

The Port Status displays the Port, Speed, and Analyzer.

In addition to displaying OOB, Link, Frame, and Error, a display showing the % buffer full opens when a trigger occurs.

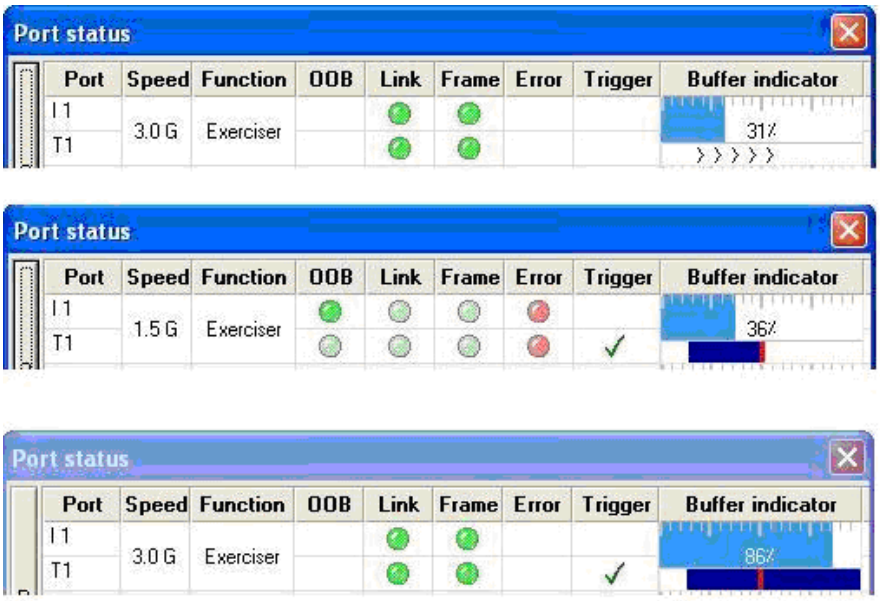
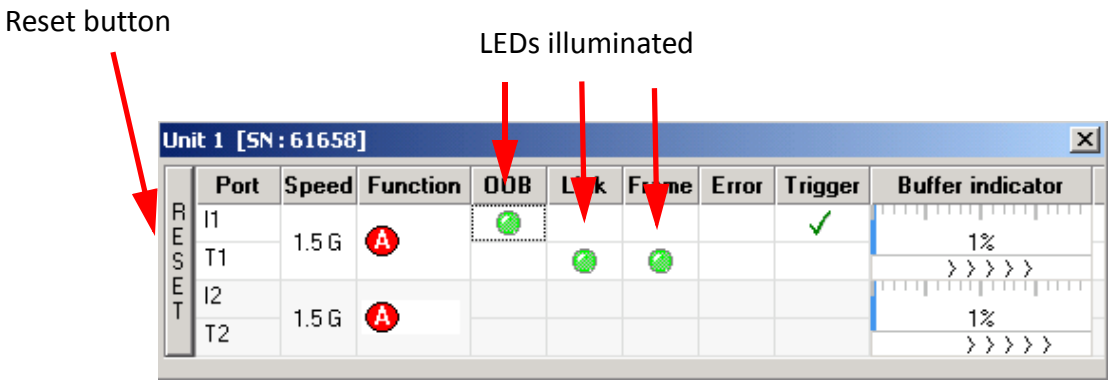


Figure 3.115: Port Status Window and Capturing Time

1. Pre-trig capturing (trig is 50%)
2. Trig point (shown by red bar; 36% pre trig was captured)
3. Post-trig capturing (50% post-trig was captured and capturing has stopped)

Note: If sample capture occurs with more than one unit active, additional Port Status windows display.

The OOB, Link, Frame and Error LEDs in the Port Status dialog mimic/follow the LEDs on the Front panel of the unit.



When the LEDs are dim, it indicates they were lit in the past. Pressing the Reset button erases this history and the illuminated LEDs are removed from the dialog.

Toolbars

Enabling Tool Bars

To customize the Viewer Display workspace, you can enable and reposition the available toolbars. To display or hide toolbars, select **View > Toolbar**, then check or uncheck toolbars (see following screen capture).

Toolbars are:

- Main
- Record + Capture
- Analysis
- Navigation + View
- Packet View
- Column View
- Cursor Position
- Device/Target Emulator

Once enabled, the toolbars can dock at the Viewer Display window or float on the windows desktop.

Cursor Position Status Bar

To display the cursor position status bar, select **Toolbar > Cursor Position**.

Figure 3.116: Cursor Position Toolbar

See “Using the Cursors and Bookmarks” on page 194.

Status Bar

The Status bar is located at the bottom of the main display window.

Search Status

The right most segment displays the current search direction: **Fwd** (forward) or **Bwd** (backward). Change the search direction from the Search Menu or double-click the Search Status segment.

Using the Cursors and Bookmarks

Cursors

The data viewer display incorporates three cursors labeled **X, Y,** and **T.** All cursors are initially overlaid and positioned at location 0, which is the trigger position of the display. The Trigger, or **T**, cursor is the measurement reference and is always at location 0 in the display.

Positioning the X Cursor

To position the X-Cursor within the viewer data display, click the left mouse button in the gray bar on the left side of the sample viewer next to the line in which to place the cursor.

Positioning the Y Cursor

To position the Y-cursor within the viewer data display, click the right mouse button in the gray bar on the left side of the sample viewer next to the line in which to place the cursor.

Note: You can also left-click to set the X-cursor and right-click to set the Y cursor in the Frame and Column View by clicking in the narrow strip on the very left side of a cell. Similarly, you can set the cursors in the Waveform View by left and right clicking at the beginning of a waveform.

Time

Time differences between the cursors are displayed in the Cursor Position toolbar. To display the cursor position toolbar, select **Toolbar** from the view menu and choose Cursor Position.

Figure 3.117: Cursor Position Toolbar

Display Configuration

The Analyzer ships with a default display configuration of field and viewer settings. You can define your own field and viewer settings for a particular testing scenario. Right-click in the Packet View and select **Display Option**. The Trace Viewer Configuration dialog displays.

Trace Viewer Configuration

The Trace Viewer Configuration dialog allows you to change the following display settings **(see** following screen capture**)**:

- Field Setting
  - Format (Decimal, Hexadecimal, Binary)
  - Visible
  - Byte Order (Right Align, Left Align)
- Field Header Setting
  - Text (color)
  - Name
  - Abbreviation
  - Foreground (color)
- Viewer Setting
  - Wrap Packet
  - Enable Tooltips
- Data Payload
  - Columns in Row (1, 2, 4, 8, 16)
  - Bytes in Column (1, 2, 4, 8, 16)
- Time Stamp Origin: Absolute, Trigger, User Defined, Based on System Time
- Same color for start time and port
- Enable Packet View Condense Mode
- Time Stamp Format (LeCroy, Milli, Micro)
- Save Trace Viewer Configuration in a file
- Load Trace Viewer Configuration from a file
- Factory Setting (restores default settings)
- Font (opens Font dialog)

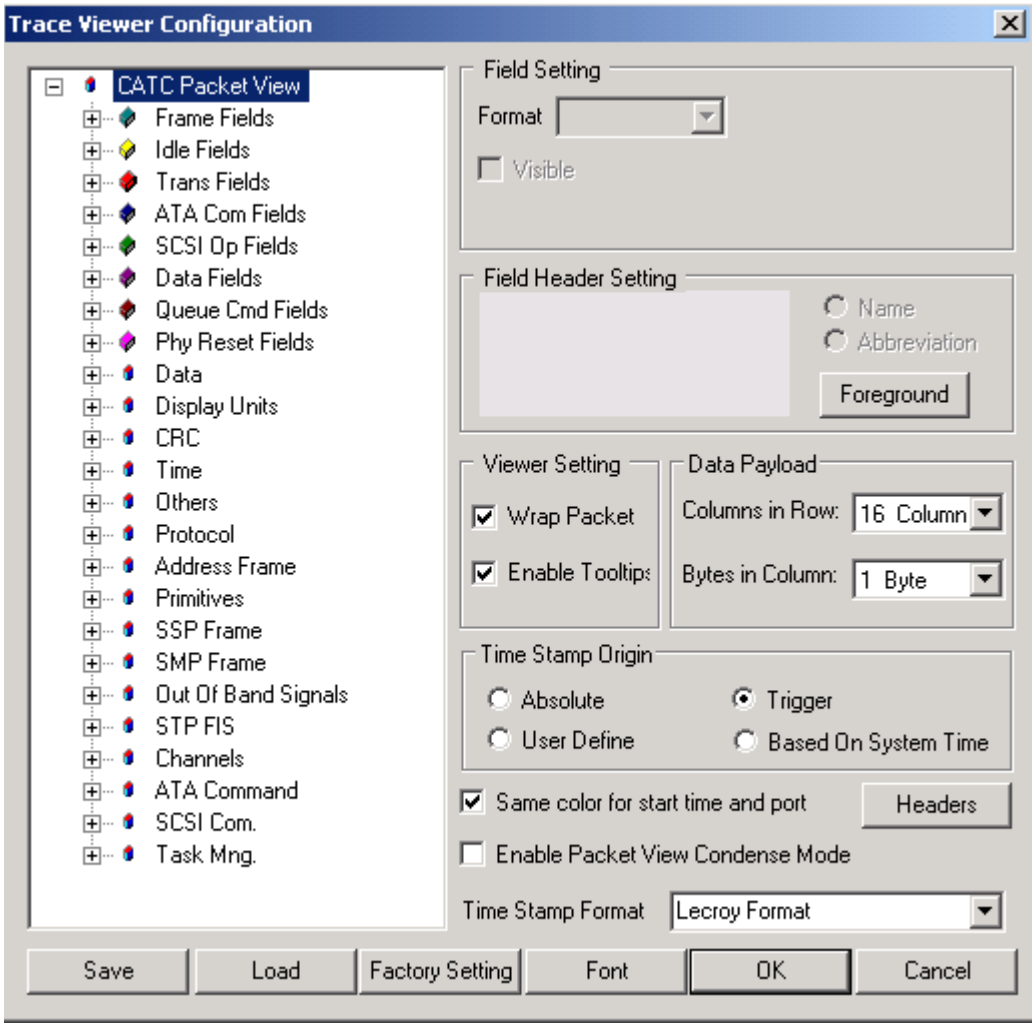


Figure 3.118: Trace Viewer Configuration

Field Setting

To view a packet field, select a field from the packet field tree and check the **Visible** box. Uncheck it to hide the field. To change the data format of a packet field, select the field and choose a data format from the Format drop-down list.

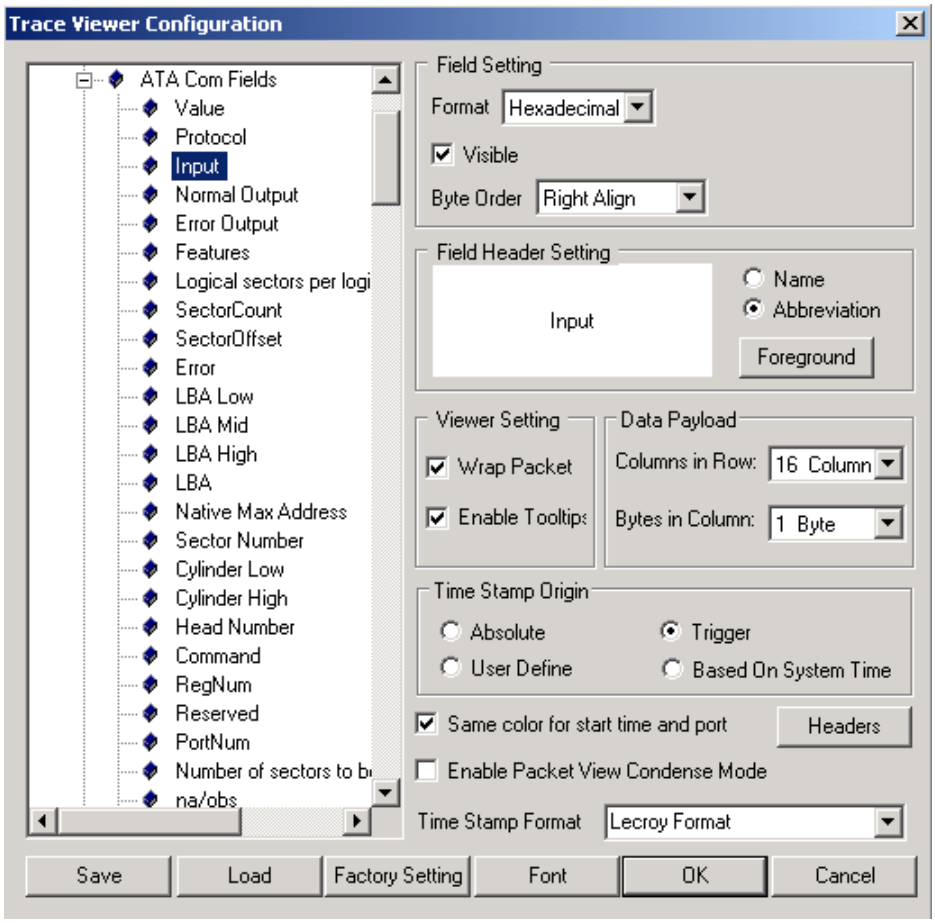


Figure 3.119: SCSI Command Fields

Field Header Setting

You can use the Name or Abbreviation.

To change the color of the text in a packet field header, select a field from the packet field tree and click the **Foreground** button.

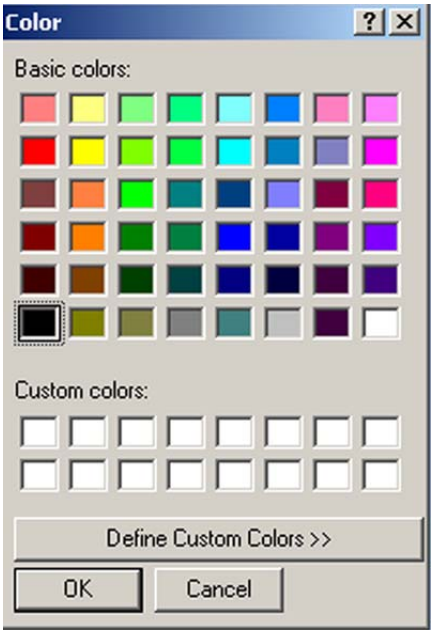


Figure 3.120: Color

Choose an appropriate color and click **OK.**

Viewer Setting

Check the **Wrap Packet** box to enable the wrapping of packets in the display.

Check the **Enable Tooltip** box to enable tool tips for packet fields.

Data Payload

You can format the Data Payload display.

For Columns in Row, select 1, 2, 4, 8, or 16.

For Bytes in Column, select 1, 2, 4, 8, or 16.

Time Stamp Origin

Select Absolute, User DEfined, Trigger, or Based on System Time.

Start Time and Port

You can use the same color for the start time and port.

Packet View Condense Mode

You can enable Packet View Condense Mode to minimize Packet View rows.

Time Stamp Format

Select LeCroy, Milliseconds, or Microseconds.

Font

To change display fonts, click the **Font** button to open the Font dialog box.

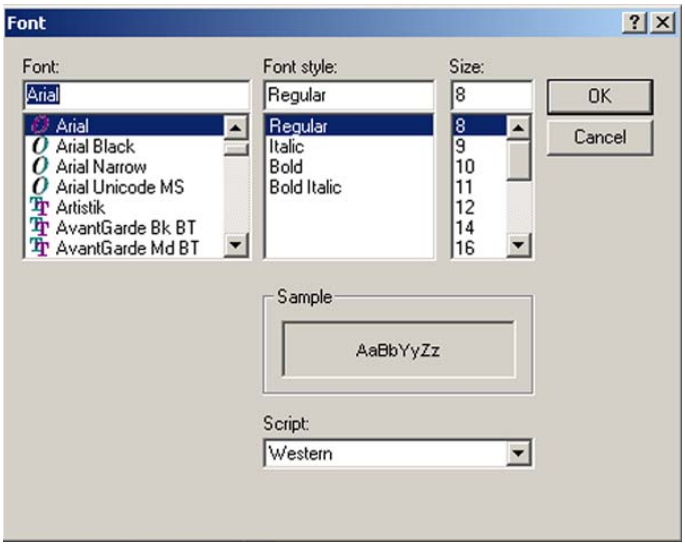


Figure 3.121: Font

Choose the font, font style, and size, and click **OK.**

Save/Load Settings

You can save the customized configuration settings in a ***.cfg** file by clicking the **Save** button and completing the Save As procedure. To load a previously saved configuration file, click **Load** and choose an appropriate file.

Set Port Alias

Port Alias allows you to assign a meaningful name to each port to assist in interpreting the results displayed in the sample view.

To assign port names in an open sample view, select **Setup > Set Port Alias**.

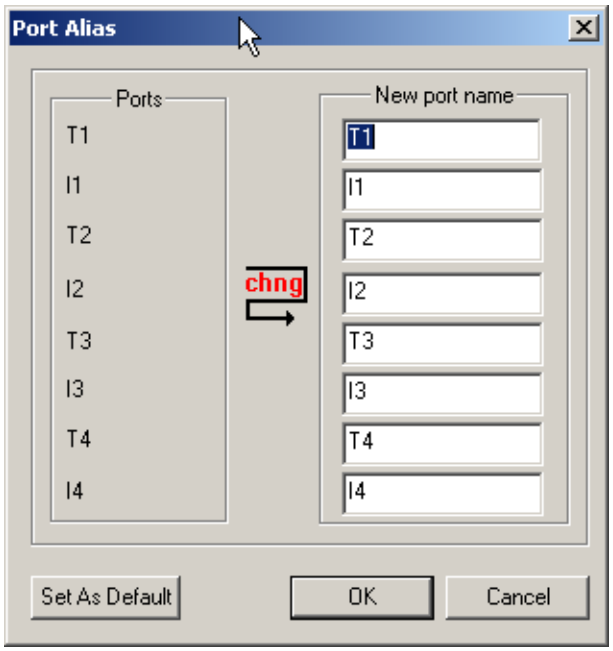


Figure 3.122: SAS: Assign Port Alias

Assign a meaningful name to each port in use and click **OK**. The assigned names replace the port numbers in the sample view.

If you elect to save the capture sample file, the assigned port names are saved together with the result, so that when you open the sample file later, the assigned names are retained.

Set As Default

If you want to set these port aliases for sample files that will be captured later, you can set them as default, and new samples will be opened by these default port aliases.

SAS Address Alias (SAS only)

SAS Address Alias allows you to assign a meaningful name to each SAS address to assist in interpreting the results displayed in the sample view. To assign SAS address names in an open sample view, select **Setup > Set SAS Address Alias.**

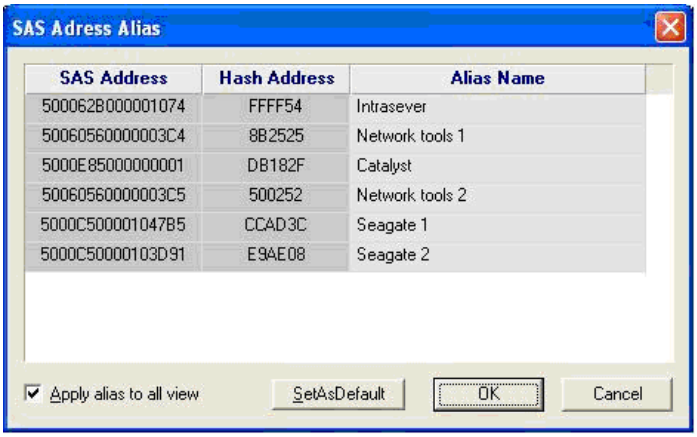


Figure 3.123: SAS: Assign SAS Address Alias

Assign a meaningful name to each SAS address in use and click **OK**. The assigned names replace the SAS address in the sample view, Search, filter,. and Statistical report.

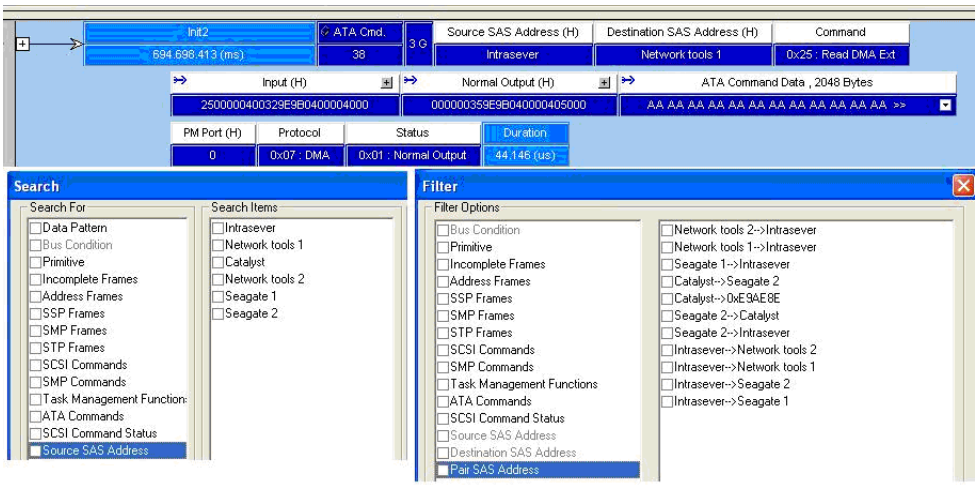


Figure 3.124: SAS: SAS Address Alias

If you elect to save the captured sample file, the assigned SAS address names are saved together with the result, so that when you open the sample file later, the assigned names are retained.

Set As Default

If you want to set these SAS address aliases for sample files that will be captured later, you can set them as default, and new samples will be opened by these default SAS address aliases.

Tx Vout & Preemphasis

The analyzer incorporates the ability to select TX Vout for the transmitter on each port. Selecting TX Vout increases the output voltage swing above the nominal value, for test and characterization purposes. This feature is also useful to compensate for line loss when driving long cables.

To select TX Vout, select **Setup > Tx Vout & Preemphasis** to display the Rx/Tx Settings dialog.

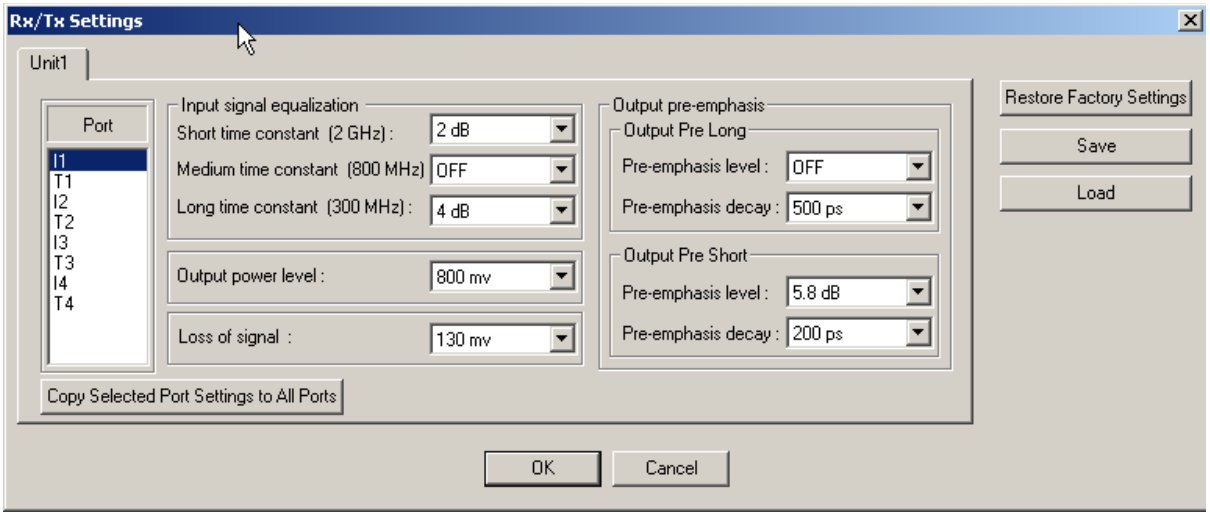


Figure 3.125: Choose Port for TX Vout

Copy Selected Port Settings to All Ports implements one port's setting into all other port settings.

Restore Factory Settings restores default values.

Save saves the new values as a ***.sng** file.

Load loads back the saved ***.sng** file.

Software Settings

Software Settings allow you to define template files for new Analyzer projects, to specify how sample files appear when opened, and to set ATAPI Spec Assignment.

To perform software settings in an open sample view, select **Setup > Software Settings**.

General Tab

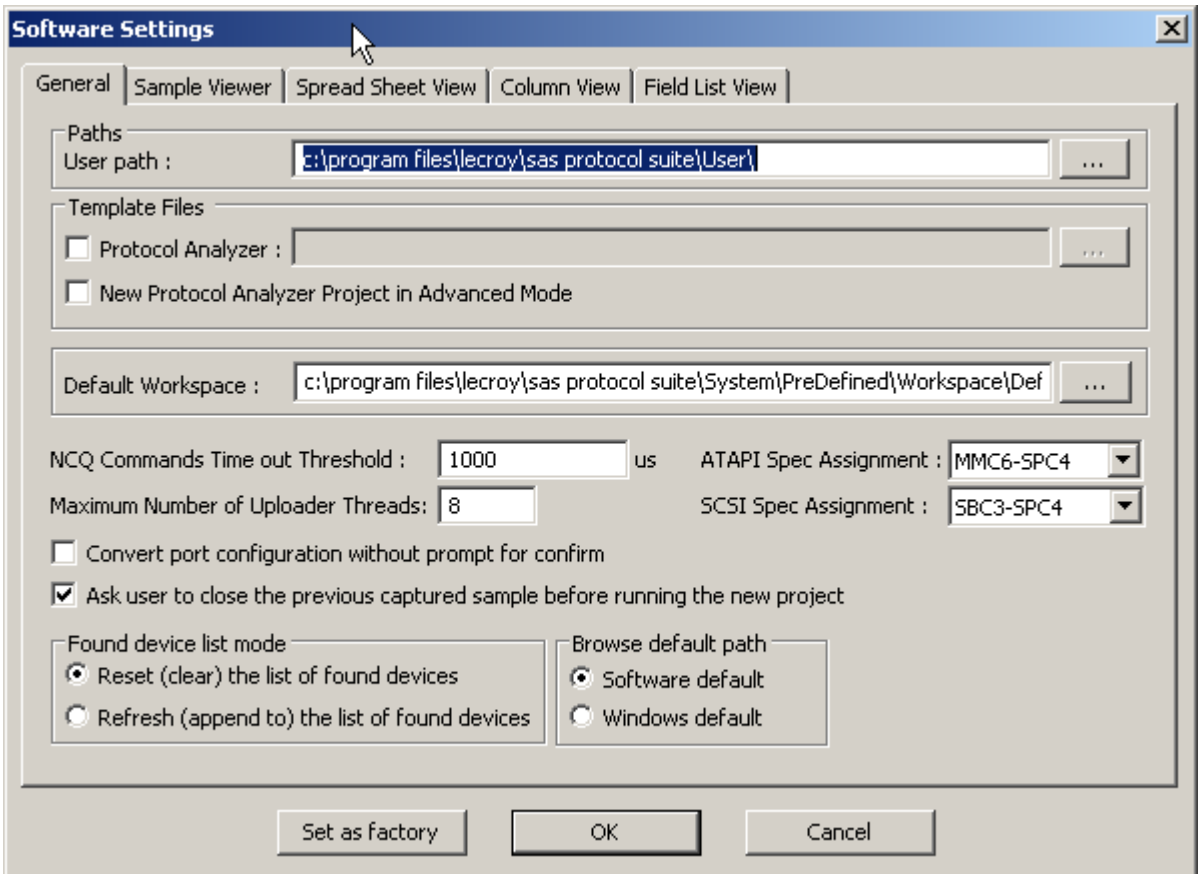


Figure 3.126: SAS: Software Settings Dialog General Tab

The SATA Software Settings dialog has the same options, except that it does not have “SCSI spec assignment”.

Paths

User Path specifies the “User” folder path, used by the software after launching the Open dialog.

Template Files

Protocol Analyzer: You can use a pre-saved analyzer and/or analyzer/emulator project file as a template. Whenever you make a new project file, the software uses the template to initialize the project file.

New Protocol Analyzer Project in Advanced Mode: When you use the New menu item to create a new project file, the software switches to Advanced mode automatically.

Other

Default Workspace specifies the default workspace file for opening a sample file. You can save any viewer configuration as a workspace and then specify it as the default workspace. The software always open a trace file based on the default workspace file.

NCQ Commands Time out Threshold: The software uses this setting in the statistical ATA command page for NCQ commands. If the time out exceeds this setting, the software reports an error.

Maximum Number of Uploader Threads: If Quick View is not enabled, during cascading, specifies the number of concurrent processes for uploading a sample file.

ATAPI spec assignment: Specifies the ATAPI default spec.

SCSI spec assignment (SAS only): Specifies the SCSI default spec.

Convert port configuration without prompt for confirm: If the current attached board does not support the project file port configuration, the software converts it to a supported port configuration without asking for confirmation. If this setting is unchecked, the software asks for confirmation

Ask user to close the previous captured sample before running the new project: When you start to run a new project, the software prompts you to close the current sample.

Found Device List Mode

Reset (clear) the list of found devices: Lists only the currently found devices.

Refresh (append to) the list of found devices: Adds new devices to the list of devices found previously.

Browse Default Path

Software default: After you select **File > Open**, the Open dialog shows the default user folder.

Windows default: After you select **File > Open**, the Open dialog shows the path selected when the Open dialog was last used.

Trace Viewer Tab

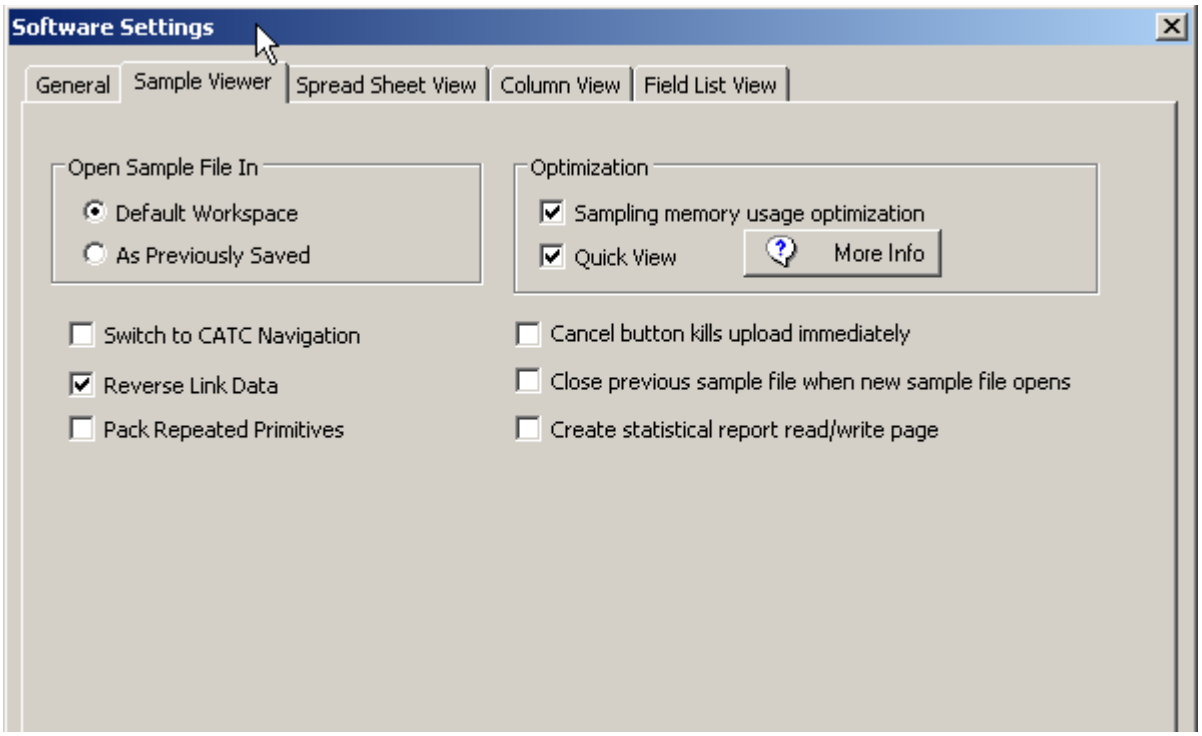


Figure 3.127: SAS: Software Settings Dialog Sample Viewer Tab

The SATA Software Settings dialog has the same options.

Open Trace file In

Default Workspace: The software opens a sample file in view(s) based on the specified default workspace.

As previously saved: The software opens a sample file in view (views) based on the last saved configuration for the sample file.

Optimization

Sampling memory usage optimization: Enables memory cascading for two ports. The analyzer will use memory of another port if there is not data on another port. See “Sampling Memory Usage Optimization” on page 209.

Quick View: Quick View allows full access to the whole trace more quickly, especially when using a Gigabit Ethernet connection. However, the trace is NOT written to the Host PC hard drive. To save the trace, you must manually click **Save**.
If you do not check Quick View, the trace loads more slowly but is automatically saved to the Host PC hard drive.

Other

Switch to CATC Navigation: Packet view will open in CATC mode.

Reverse Link Data: The software shows DWORDs of link data as reversed.

Pack Repeated Primitives: The software packs repeated primitives just after opening a sample file.

Cancel button kills upload immediately: The software kills the uploading process if you press **Cancel**.

Close previous sample file when new sample file opens: When you want to open a new sample file, the software closes any open sample files.

Create statistical report read/write page: The software creates a Read/Write page in the statistical report. Enabling this setting displays the **Read/Write Stream DMA** command in the Read/Write page.

Spread Sheet View Tab

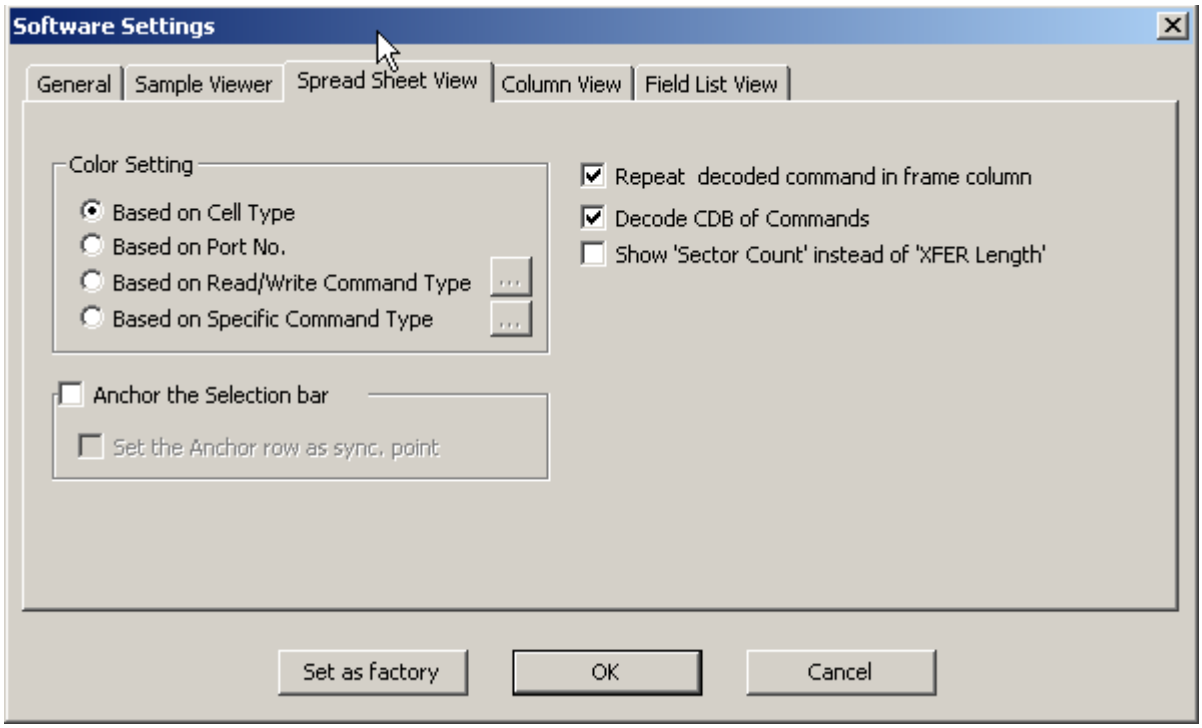


Figure 3.128: SATA: Software Settings Dialog Spread Sheet View Tab

The SAS Software Settings dialog has the same options, except that it does not have “Show ‘Sector Count’ instead of ‘Xfer Length”.

Color Setting

Based on Cell Type: Each column has its own color.

Based on Port No.: Data of each row are shown based on the specified color for its port. You can set the color of ports in the Viewer settings.

Based on Read/Write Command Type: You can specify a color for Read commands, another color for Write commands, and other color for other commands. The software shows each row based on the command type: Read, Write, or others.

Based on Specific Command Type: You can specify a color for each command. The software applies the setting on the Command column.

Anchor the Selection bar

You can anchor the selection bar of the Spreadsheet View.

Set the Anchor row as sync. point: Other views synchronize based on the contents of the anchor row.

Other

Repeat decoded command in frame column: The spreadsheet shows the name of the command in front of all frames in the Command column. Otherwise, it will show the name of the command only in front of the SSP command frame.

Decode CDB of Commands: The spreadsheet shows name of command in command column, otherwise shows CDB of command in command column.

Show 'Sector Count' instead of 'Xfer Length' (SATA only): Display sector count.

Column View Tab

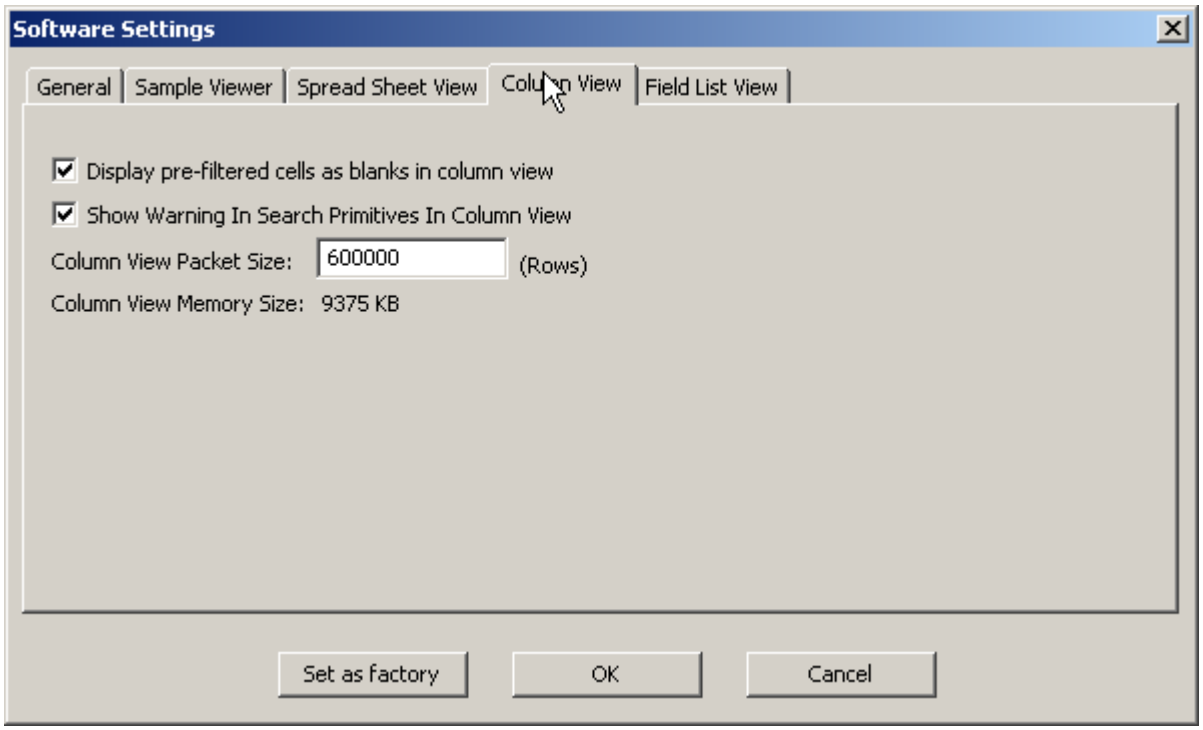


Figure 3.129: SAS: Software Settings Dialog Column View Tab

The SATA Software Settings dialog has the same options.

Other

Display pre-filtered cells as blank in column view: The software shows pre-filtered data (already filtered in the capture project), as blank cells. Otherwise, it will show them as “pre-filtered” cells.

Show Warning in Search Primitive In Column View: If searching in Column View takes a long time, the software asks if you want to continue search. Otherwise, the software continues searching with no pause.

Column View Packet Size: Specifies the allocated buffer for showing rows of a packet in Column View: When you see “Too Large” in a Column-View cell, the current allocated buffer is not enough and you should increase it by changing this setting.

Column View Memory Size: Displays the memory buffer.

Field List View Tab

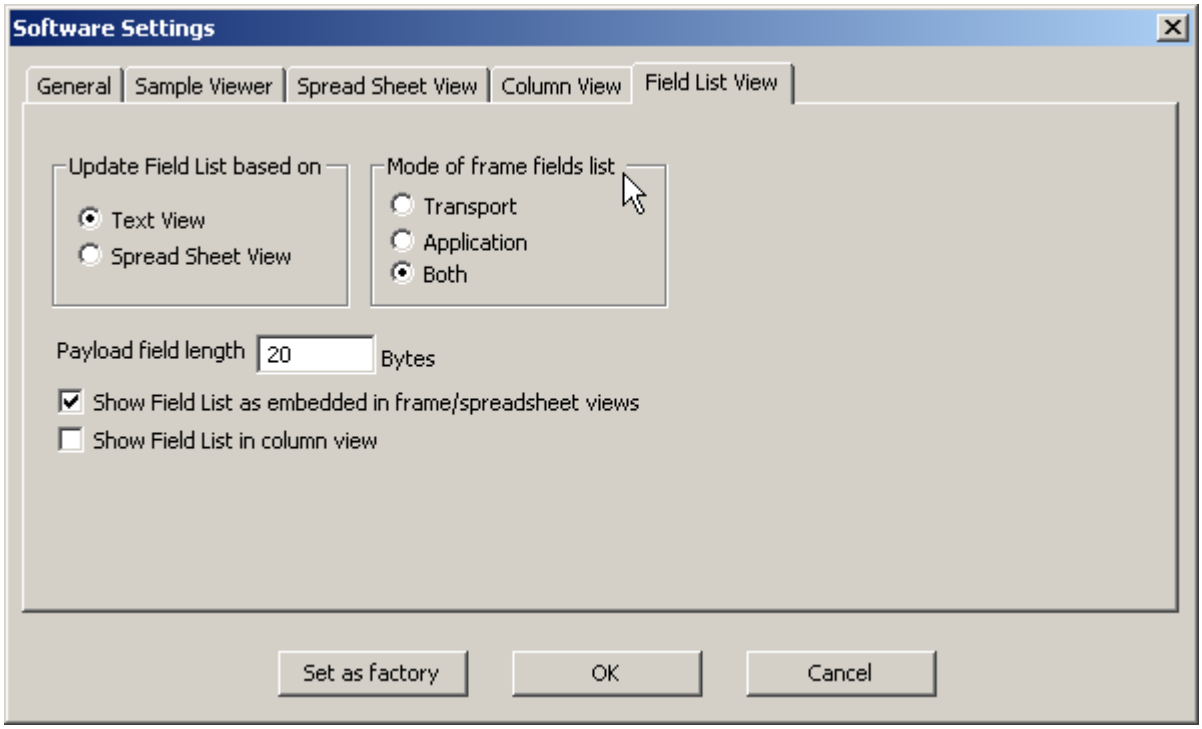


Figure 3.130: SAS: Software Settings Dialog Field List View Tab

The SATA Software Settings dialog has the same options.

For additonal information on Field List View, refer to “Histogram View” on page 151.

Update Filed List based on

Text view: The software updates the contents of the Field List based on the current Text View.

Spreadsheet view: The software updates the contents of the Field List based on the current Spreadsheet View.

Mode of frame field list

Transport: Shows decoding of transport layer.

Application: Shows decoding of Application layer.

Both: Shows decoding of both transport and application layers.

Other

Payload field length: Specifies the number of bytes that are shown in the field list for payload fields.

Show Field List as embedded In frame/spreadsheet views: The Field List is embedded in frame/spreadsheet views. Otherwise, it will open as a separated view.

Show Field List in Column View: The software embeds the Field List in the column. Otherwise, the Field List is not in Column View.

Sampling Memory Usage Optimization

The Software Settings dialog has a Sampling Memory Usage Optimization option. This Memory Assignment (MA) feature optimizes sampling memory utilization.

If the Sampling Memory Usage Optimization Option is Checked

The system tries to use empty space in all memory banks to prevent any memory bank from filling completely. Each physical link is not necessarily assigned to a specific memory bank. The system can capture more sample data than if the MA option is unchecked, and sample file size is closer to the user-defined Sampling Memory Size.

Memory Assignment efficiency varies with Port Configuration and Trigger Position:

- **FPGA**: The Memory Assignment feature works for a pair of ports connected to one FPGA, for example ports 1 and 2 (or ports 3 and 4). Memory Assignment does not work for two ports connected to different FPGAs, for example ports 1 and 3.
- **Triggering**: Memory Assignment only starts after the trigger point. During pre-trigger, each physical link is always assigned to a specific memory bank. Post-trigger, the system can try to use empty space in all memory banks, if you check the MA option. Therefore, Memory Assignment efficiency is maximum when Trigger Position is set to 0% (snap-shot trigger) and is minimum when Trigger Position is set to 99% or when there is no triggering (you stop recording manually).
- **MUX**: When MUX is enabled, each segment has four memory banks, limiting Memory Assignment somewhat.

Here are examples of different Port Configurations and Trigger Positions:

- **One port configuration (A - - -):** Sample size is user-specified sample size.
- **Two port configuration (AA - -)**: Ports 1 and 2 are on the same FPGA, so Memory Assignment has an effect. If you use snapshot triggering, the sample size is near specified size.
- **Two port configuration (AA - -):** If you use manual stop, Memory Assignment has no effect. Sample size depends on port traffic loads.
- **Two port configuration (AA - -)**: If trigger is set at 50%, and there is enough data to fill pre-trigger, Memory Assignment has an effect. Sample size is typically near specified size.
- **Two port configuration (AA - -)**: If trigger is set at 50%, but there is not enough data to fill pre-trigger, Memory Assignment has an effect. Sample size is typically more than half specified size, with size determined by the amount of data captured before trigger.
- **Two port configuration (A - A -)**: Ports 1 and 3 are not on the same FPGA, so Memory Assignment has no effect. If one port has heavy traffic, it may fill its memory bank and stop recording, resulting in smaller sample size than specified.

Note: Checking this option does not affect the sample. It only allows larger sample sizes.

Note: If traffic is balanced on ports, sample size is the same whether you check or uncheck the Sampling Memory Usage Optimization option.

Note: Memory Assignment depends on traffic load distribution at the time when the system tries to re-assign physical links to memory banks. Therefore, if you repeat a capture with the same Sampling Memory Size and Segment Number parameters, the resulting sample size may not be the same. However, if traffic load distribution is similar, sample size will be similar.

Note: The buffer status indicator shows buffer by FPGA, not by port.

If the Sampling Memory Usage Optimization Option is Not Checked

Each physical link (or logical link if MUX is enabled) is assigned to a specific memory space (memory bank), depending on the Sampling Memory Size and Segment Number parameters.

Important: If **any** physical link fills its memory bank, the recording process stops. Other memory banks will typically be less than full (and can be empty). The sample file might be smaller than the user-defined Sampling Memory Size. You might even think that the Analyzer malfunctioned.

Floating License

Note: License Manager is only available when in Cascading mode.

To manage the license, select **Setup > License Manager**.

The Floating License dialog displays the available functionality by Function, Total Ports, Assigned To ports, and Not Used. It also displays the Current License Configuration by License Type, Serial Number, Analyzer, Device Emulator, Host Emulator, and InFusion.

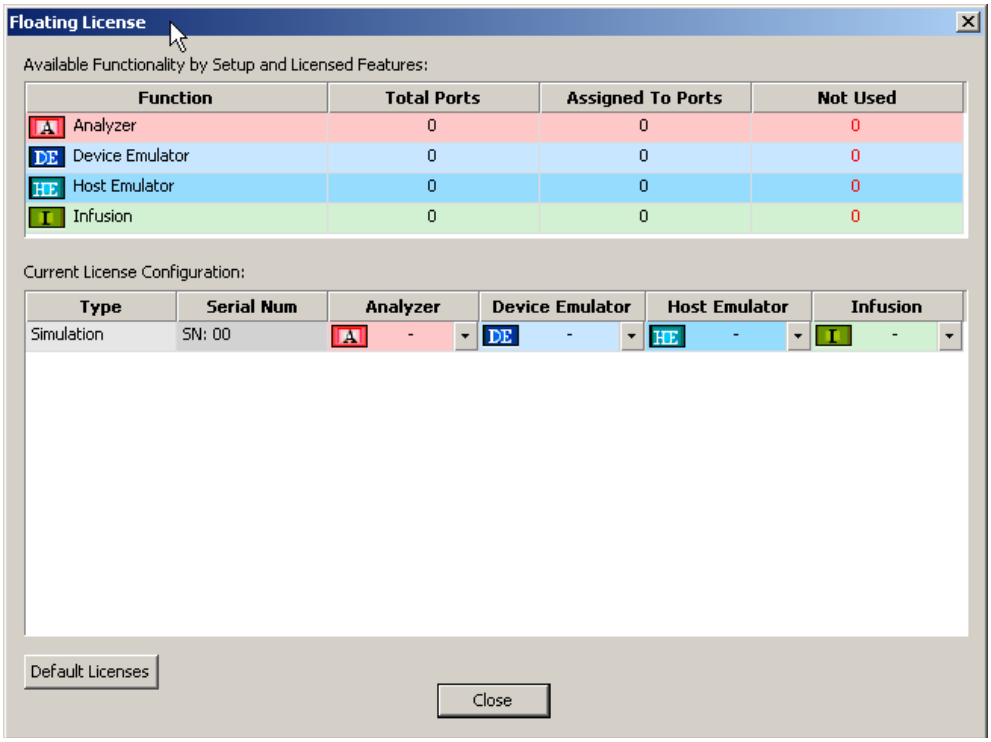


Figure 3.131: Floating License Dialog

External Trig Setting

The External Trig Setting dialog displays the External Trig Out Setting and External Trig In Setting as High Active, Low Active, or Toggle.

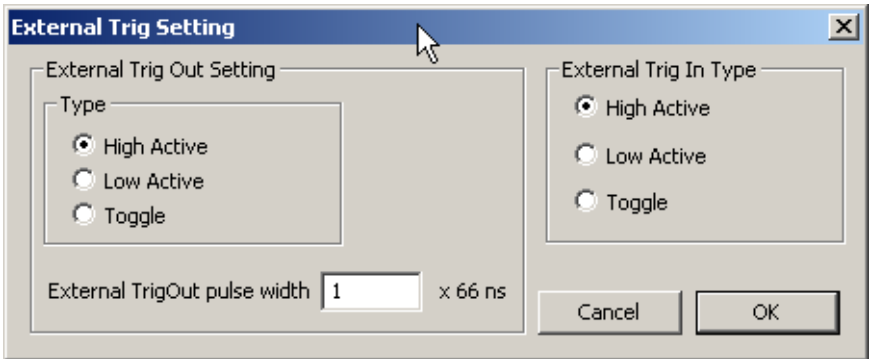


Figure 3.132: External Trigger Setting Dialog

To display the External Trig Setting dialog, select **Setup > External Trig Setting**.

External Trig Out Setting

The Analyzer can send a Low or High external signal anytime a trigger occurs. Select the External Trig Out Setting: High Active, Low Active, or Toggle from High to Low or Low to High once (3.3 V output).

Enter the External TrigOut pulse width.

External Trig In Setting

An external Low or High input signal can cause triggering. Select the External Trig In Setting: High Active, Low Active, or Toggle from High to Low or Low to High once (3.3 V output).

Update Device

The Update Sierra Device command allows you to update a Sierra M6-1 Analyzer or CATC-Sync expansion card whose current version is incorrect.

1. Click **Setup > Update Sierra Device** to display the Device Setup dialog.

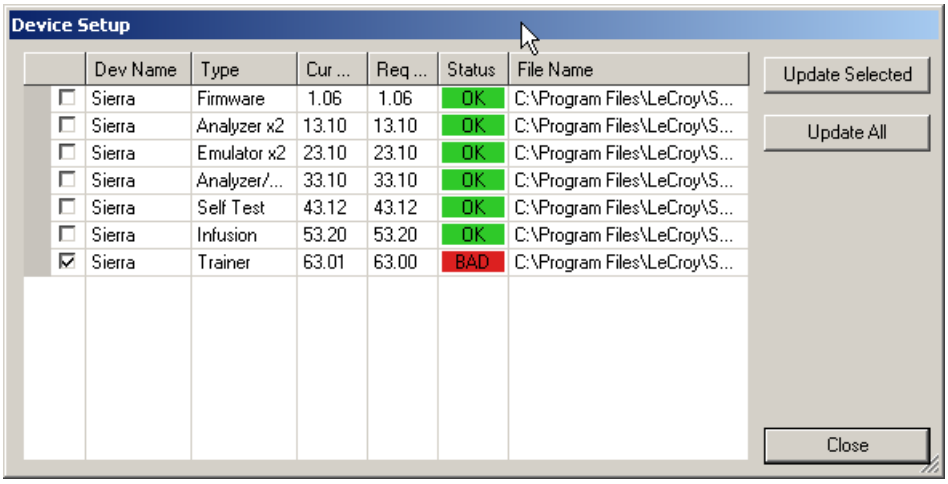

Device Setup
Dev Name
Type
Cur ...
Req ...
Status
File Name
Sierra Firmware 1.06 1.06 OK C:\Program Files\LeCroy\S...
Sierra Analyzer x2 13.10 13.10 OK C:\Program Files\LeCroy\S...
Sierra Emulator x2 23.10 23.10 OK C:\Program Files\LeCroy\S...
Sierra Analyzer/... 33.10 33.10 OK C:\Program Files\LeCroy\S...
Sierra Self Test 43.12 43.12 OK C:\Program Files\LeCroy\S...
Sierra Infusion 53.20 53.20 OK C:\Program Files\LeCroy\S...
Sierra Trainer 63.01 63.00 BAD C:\Program Files\LeCroy\S...
Update Selected
Update All
Close

Figure 3.133: Device Setup Dialog with BAD Device Status

Devices whose version is correct have an OK status.
A device whose version is incorrect has a BAD status.

Note: You can click the ellipses (...) at the end of a file path and name to display an Open dialog, in which you can browse for files.

---

2. Click the checkbox to the left of a device with BAD status, then click **Update Selected** to begin the process that will make the Analyzer version correct.

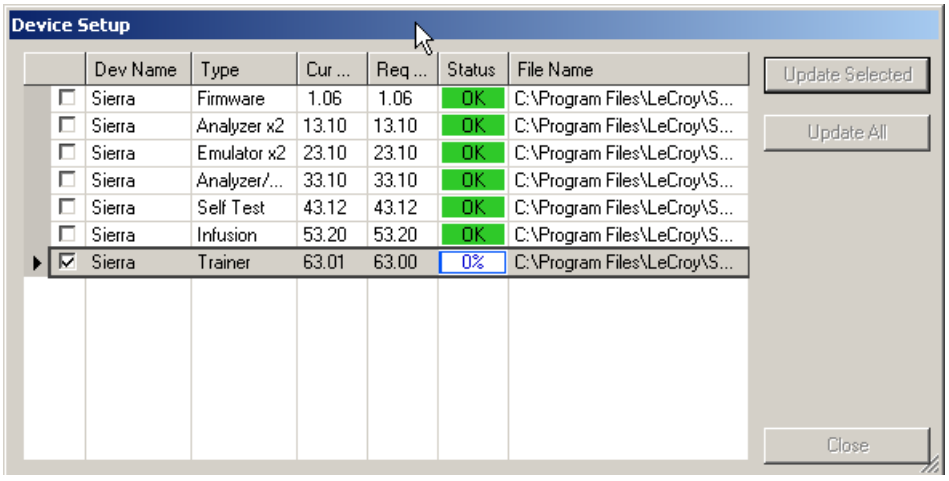

Device Setup
Dev Name
Type
Cur ...
Req ...
Status
File Name
Sierra Firmware 1.06 1.06 OK C:\Program Files\LeCroy\S...
Sierra Analyzer x2 13.10 13.10 OK C:\Program Files\LeCroy\S...
Sierra Emulator x2 23.10 23.10 OK C:\Program Files\LeCroy\S...
Sierra Analyzer/... 33.10 33.10 OK C:\Program Files\LeCroy\S...
Sierra Self Test 43.12 43.12 OK C:\Program Files\LeCroy\S...
Sierra Infusion 53.20 53.20 OK C:\Program Files\LeCroy\S...
Sierra Trainer 63.01 63.00 0% C:\Program Files\LeCroy\S...
Update Selected
Update All
Close

Figure 3.134: Device Setup Dialog Beginning to Update Status of a Device

After the update, the device must restart.

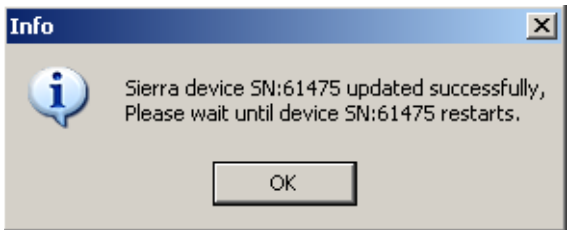


Figure 3.135: Info Dialog

Then the update is complete.

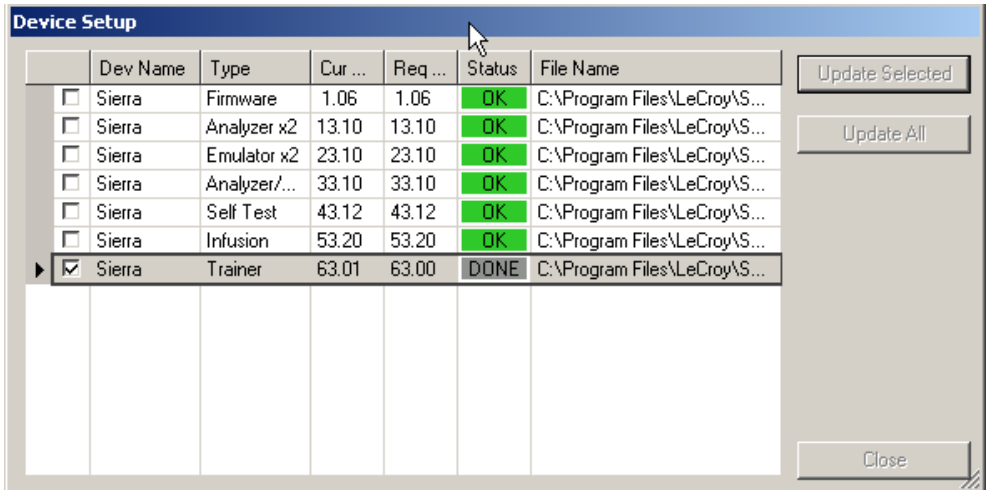

Device Setup
Dev Name
Type
Cur ...
Req ...
Status
File Name
Sierra Firmware 1.06 1.06 OK C:\Program Files\LeCroy\S...
Sierra Analyzer x2 13.10 13.10 OK C:\Program Files\LeCroy\S...
Sierra Emulator x2 23.10 23.10 OK C:\Program Files\LeCroy\S...
Sierra Analyzer/... 33.10 33.10 OK C:\Program Files\LeCroy\S...
Sierra Self Test 43.12 43.12 OK C:\Program Files\LeCroy\S...
Sierra Infusion 53.20 53.20 OK C:\Program Files\LeCroy\S...
Sierra Trainer 63.01 63.00 DONE C:\Program Files\LeCroy\S...
Update Selected
Update All
Close

Figure 3.136: Device Setup Dialog with DONE Device Status

User-Defined Decoding

User-defined decoding allows you to create a definition file to interpret commands and frames that are not in the standard set recognized by the software.

Select **Setup > User Defined Decoding** to open the User Defined Decoding dialog.

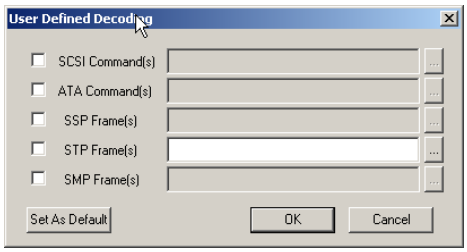


Figure 3.137: SAS: User Defined Decoding

SAS vs. SATA: SAS adds SCSI Commands, SSP Frames, and SMP Frames.

Check **ATA Commands** and/or **STP frames.** Click the ellipses next to a command type text box to display the **Open** dialog. Choose an appropriate script file and click **Open**.

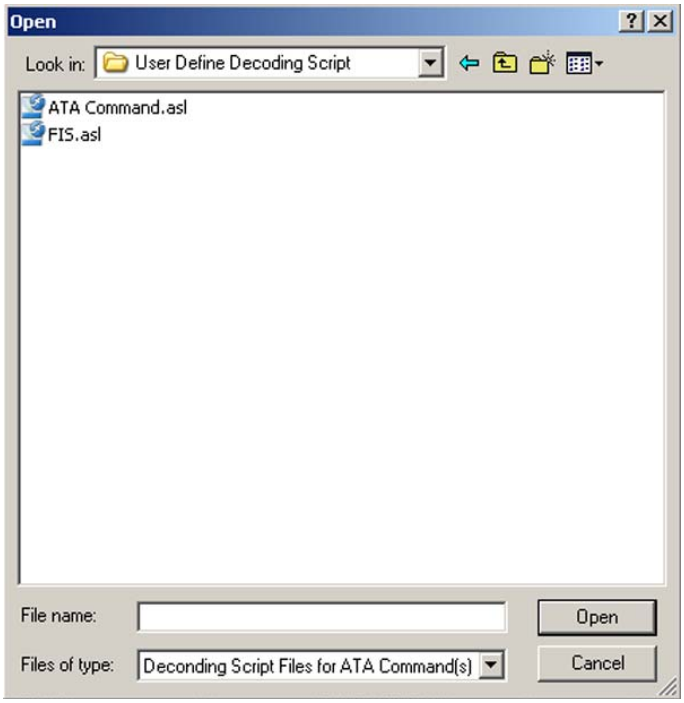


Figure 3.138: Choosing a Script File

Help Menu

Help Topics

Displays online help. You can also select F1.

VSE Help Topics

Displays VSE online help. You can also select F1.

Update License

A current license agreement with LeCroy entitles the Analyzer owner to continued technical support and access to software updates as they are published on the LeCroy website. When you obtain a license key, from the Help menu select Update License to display the Select License Key File dialog box. Enter the path and filename for the license key, or browse to the directory that contains the license key and select the *.lic file. Click Open.

Display License Information

Open a license information dialog to display a list of named features supported by the current software version (see Figure 3.139 on page 217).Named features that are not enabled on your system are indicated by No in the Purchased column. Whether or not named features are enabled depends on the license key stored in your analyzer. If you try to use a feature for which you do not yet have a license, the program displays the License Protection Message. To use the feature, you must purchase a license.

Licensing
Hamilton: (S/N : 61658 (0xF0DA))
License information for the product, Serial Number 61658 (0xF0DA) :
Software mainter
Available Features
Feature Title | Purchased | Feature Description
System Memory Size: 1GB | No | Enable operation with 1GByte of internal memory.
System Memory Size: 2GB | No | Enable operation with 2GByte of internal memory.
System Memory Size: 4GB | Yes | Enable operation with 4GByte of internal memory.
System Memory Size: 8GB | No | Enable operation with 8GByte of internal memory.
System Memory Size: 16GB | No | Enable operation with 16GByte of internal memory.
Rate Support: 1.5G | Yes | Support for 1.5GBps data rate.
Rate Support: 3G | Yes | Support for 3GBps data rate.
Rate Support: 6G | Yes | Support for 6GBps data rate.
Tool: Pattern Generator | Yes | Enable Pattern Generator.
Tool: SATA Compliance | Yes | Enable SATA Compliance.
Tool: SATA Host Emulator | Yes | Enable SATA Host Emulator
Tool: SATA Device Emulator | Yes | Enable SATA Device Emulator.
Tool: SAS Initiator Emulator | Yes | Enable SAS Initiator Emulator.
Tool: SAS Traget Emulator | Yes | Enable SAS Target Emulator.
Protocol Support: SAS | Yes | Support for SAS protocol.
Protocol Support: SATA | Yes | Support for SATA protocol.
Protocol Support: STP | Yes | Support for STP in SAS protocol.
Protocol Support: Pre-emphasis | Yes | Support for Pre-emphasis for SAS and SATA protocols.
Analysis ports: 1 | Yes | Enable one analysis port for blade.
Analysis ports: 2 | Yes | Enable two analysis ports for blade.
Analysis ports: 4 | Yes | Enable four analysis ports for blade.
Analyzer Feature: Muxing | No | Enable Muxing in analyzer.
Device/Target Emulator Ports: 1 | Yes | Enable one port for SATA Device or SAS Target.
Device/Target Emulator Ports: 2 | Yes | Enable two ports for SATA Device or SAS Target.
Device/Target Emulator Ports: 4 | Yes | Enable four ports for SATA Device or SAS Target.
Host/Initiator Emulator Ports: 1 | Yes | Enable one port for SATA Host or SAS Initiator.
Host/Initiator Emulator Ports: 2 | Yes | Enable two ports for SATA Host or SAS Initiator.
Host/Initiator Emulator Ports: 4 | Yes | Enable four ports for SATA Host or SAS Initiator.
Emulator Feature: Muxing | No | Enable Muxing in Emulator.
Trainer Ports: 1 | Yes | Enable one Trainer port for blade.
Trainer Ports: 2 | Yes | Enable two Trainer ports for blade.
Trainer Ports: 4 | Yes | Enable four Trainer ports for blade.
Infusion Ports: 1 | Yes | Enable one Infusion port for blade.
Infusion Ports: 2 | Yes | Enable two Infusion ports for blade.
Infusion Ports: 4 | Yes | Enable four Infusion ports for blade.
Infusion Feature: Muxing | Yes | Enable Muxing in Infusion.
Save As...
Close

Figure 3.139: Licensing Dialog

Check for Updates

Check whether a new software version is available. If so, you can download from the LeCroy web site.
You can select to Check for updates at application startup.

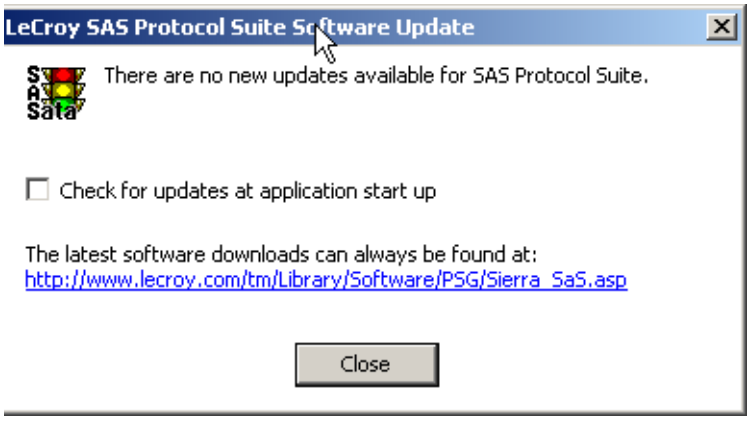

LeCroy SAS Protocol Suite Software Update
There are no new updates available for SAS Protocol Suite.
Check for updates at application start up
The latest software downloads can always be found at:
http://www.lecroy.com/tm/Library/Software/PSG/Sierra_SaS.asp
Close

Figure 3.140: Check for Updates

About

Displays version information.

Self Test

You can use the built-in RAM self-test utility. Select **Setup** on the main menu bar and choose **Self Test** to open the Self Test dialog.

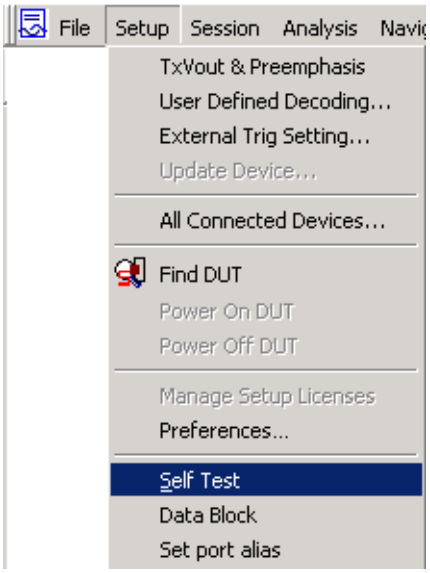


Figure 3.141: SAS: Self Test Command on Tools Menu

Clock Check

To perform a Clock check, choose the clock to test and click the **Start Clock Check** button. After a short time, the Test Result appears to the right of the selected line.

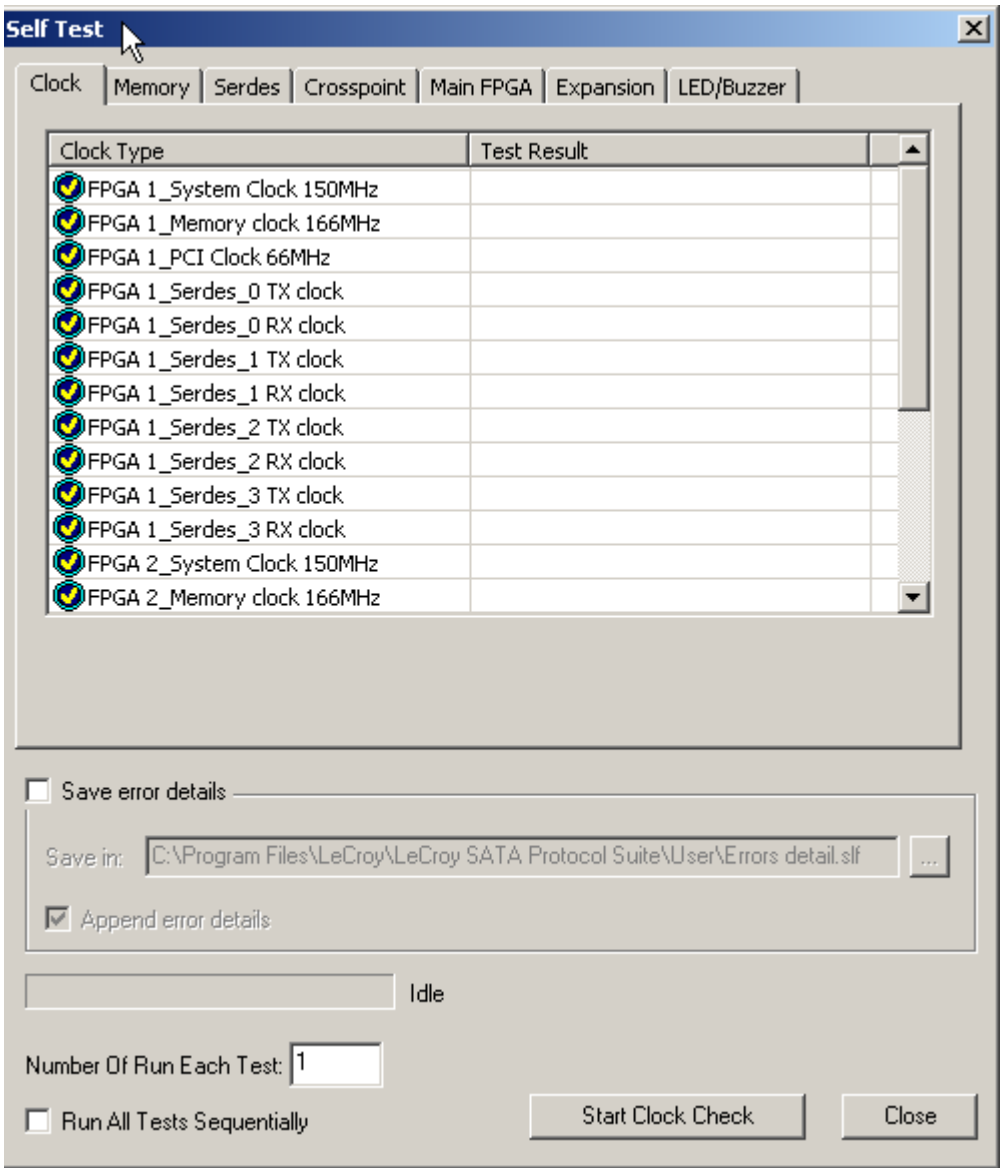


Figure 3.142: SATA: Self Test Dialog Clock Tab

Test Result: OK or Error

If a test is OK and you specified one run, the Test Result is **OK: 1 times**.

If a test has an error and you specified one run, the Test Result is **Error: 1 times**.

Saving

You can save any check result by checking the **Save error details** check box and specifying a destination file name.

Number of Runs Each Test

You can specify to run a test more than once.

Run All Tests Sequentially

This option runs all items in the Clock, Memory, Serdes, Crosspoint, Main FPGA, Expansion, and LED/Buzzer tests in order. After you check this check box, the command button becomes **Start All Tests**. You must click the **Stop Test** button on the LED/Buzzer tab to stop the check.

Memory Check

To perform a SDRAM or Exerciser RAM memory check, select the **Memory** tab.

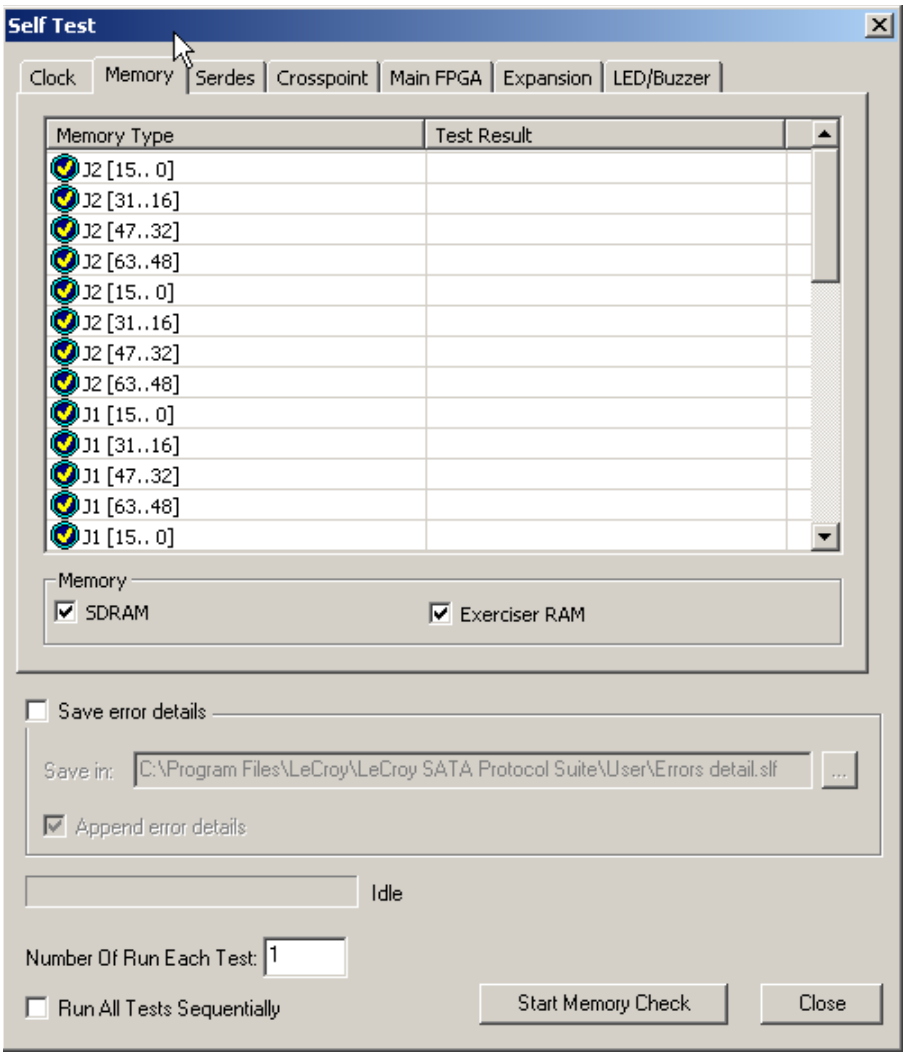


Figure 3.143: SAS: Self Test Dialog Memory Tab

Choose the SDRAM, Exerciser Data, or Exerciser Instruction to test and click the **Start Memory Check** button. After a short time, the Test Result appears to the right of the selected line.

Serdes Check

To perform an FPGA 1 or 2 Serdes Chip check, select the **Serdes** tab.

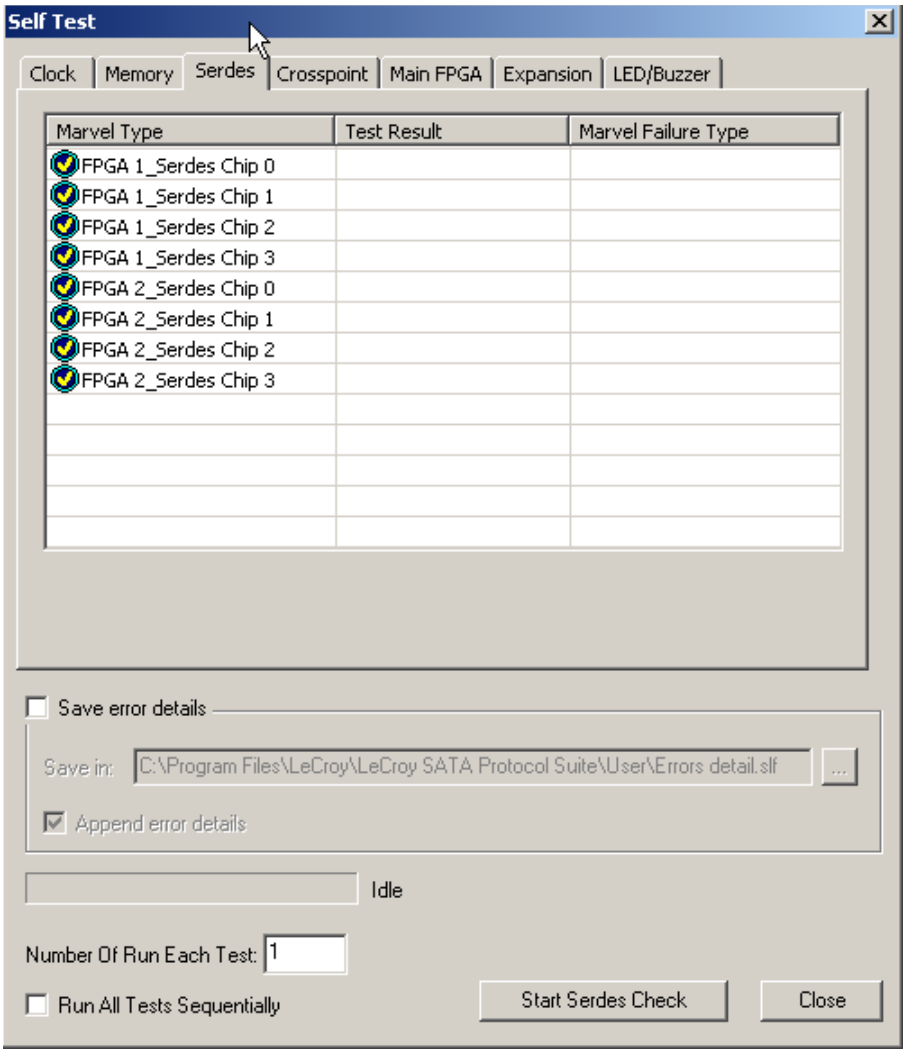


Figure 3.144: SATA: Self Test Dialog Serdes Tab

Choose the n FPGA 1 or 2 Serdes Chip to test and click the **Start Serdes Check** button. After a short time, the Test Result and Marvel Failure Type appear to the right of the selected line. Marvel Failure Type indicates the error type.

Crosspoint Check

To perform a Crosspoint-Crosspoint bus test or Crosspoint external loop back, select the **Crosspoint** tab.

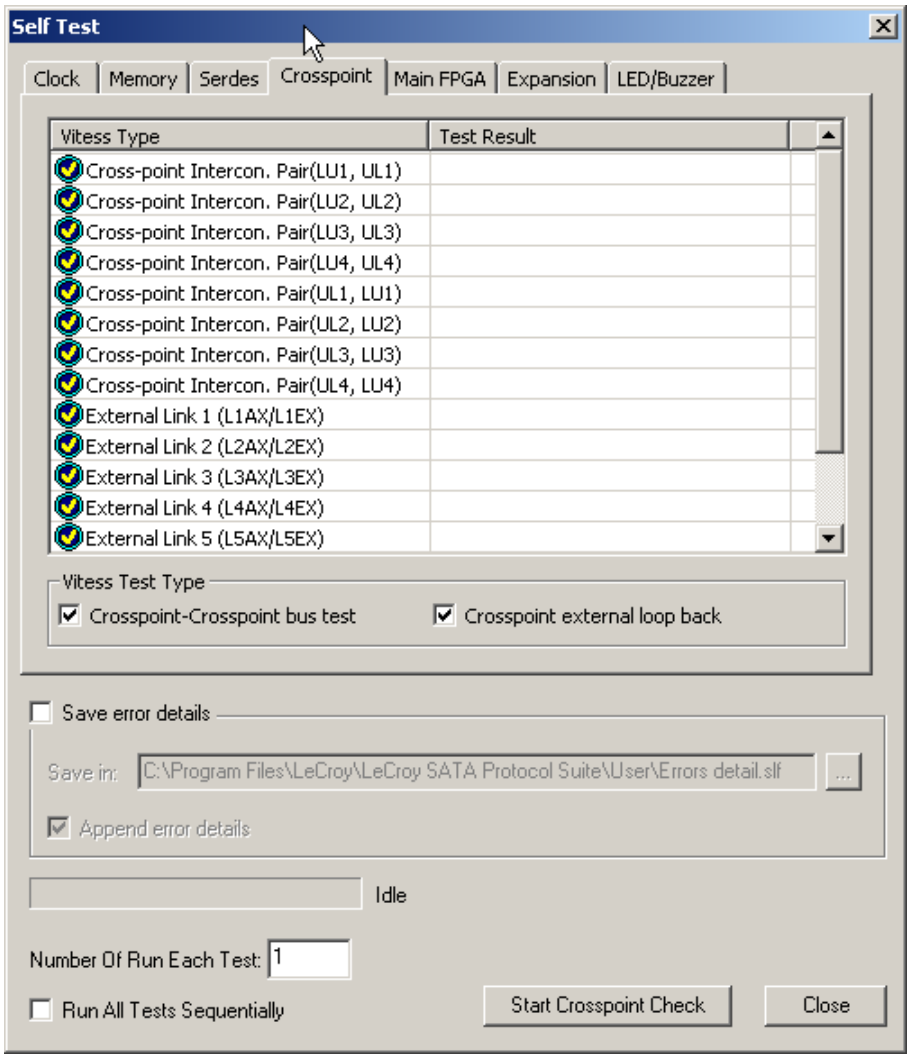


Figure 3.145: SATA: Self Test Dialog Crosspoint Tab

Choose the Crosspoint Interconnection Pair or External loop back to test and click the **Start Crosspoint Check** button. After a short time, the Test Result appears to the right of the selected line.

Main FPGA Check (SATA only)

To perform an Inter-FPGA Connection check, select the **Main FPGA** tab.

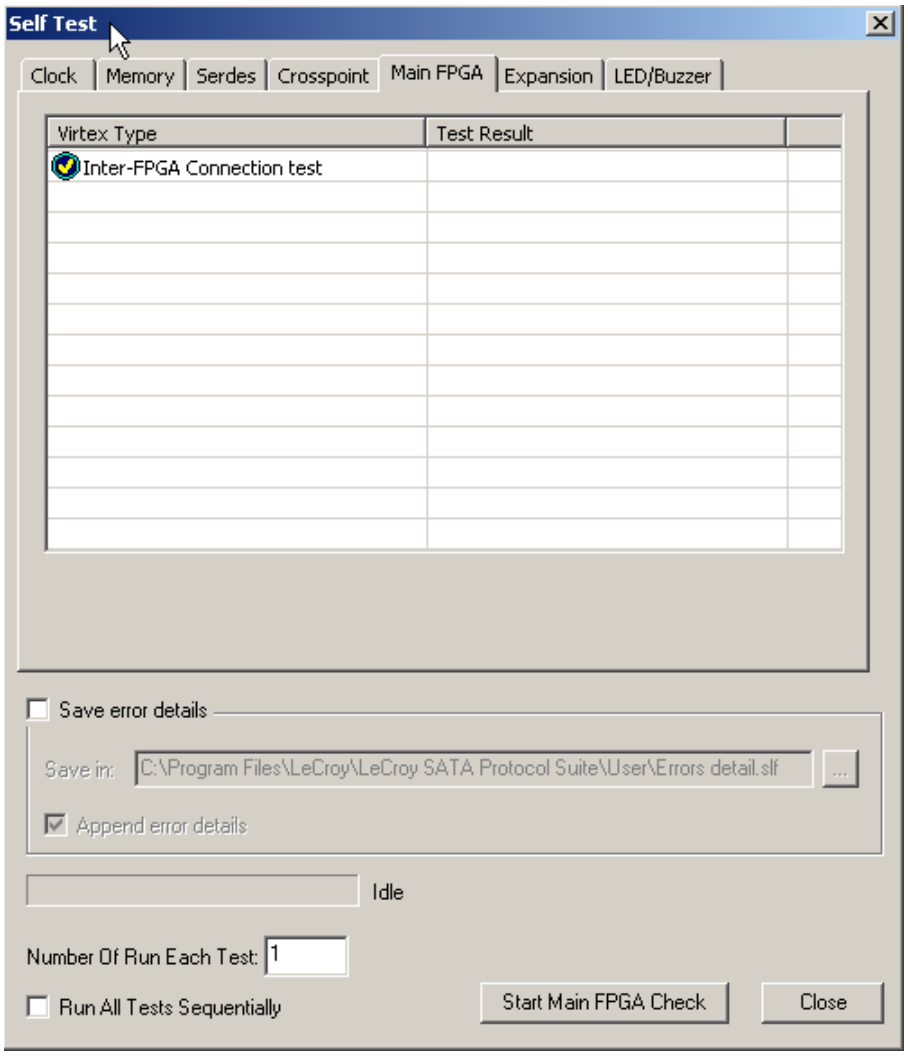


Figure 3.146: Self Test Dialog Main FPGA Tab

Choose the Inter-FPGA Connection test and click the **Start Main FPGA Check** button. After a short time, the Test Result appears to the right of the selected line.

Expansion Check

To perform a Expansion Card Data Status or Clock Status check, select the **Expansion** tab.

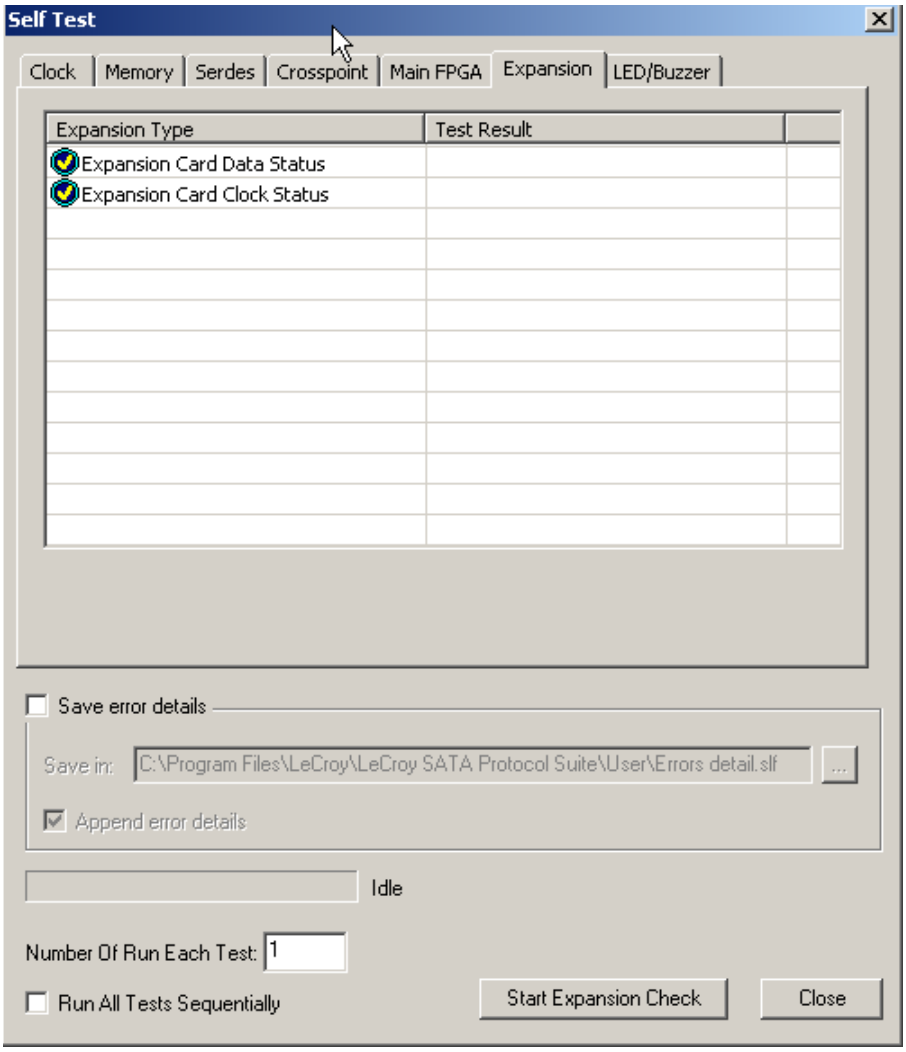


Figure 3.147: Self Test Dialog Expansion Tab

Choose the Expansion Card Data Status or Clock Status to test and click the **Start Expansion Check** button. After a short time, the Test Result appears to the right of the selected line.

LED/Buzzer Check

To perform a LED or Buzzer check, select the **LED/Buzzer** tab.

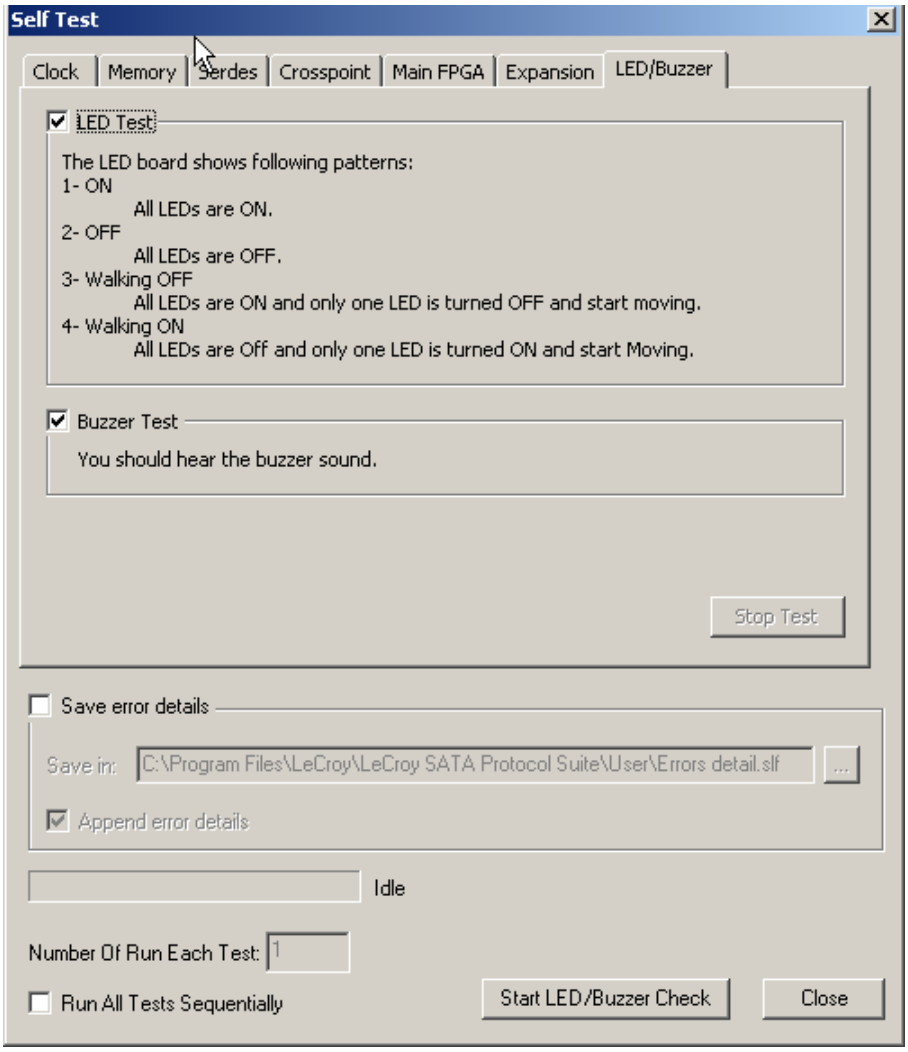


Figure 3.148: Self Test Dialog LED/Buzzer Tab

Check **LED Test** or **Buzzer Test** and click the **Start LED/Buzzer Check** button. For the LED, you should see the LED pattern. For the buzzer, you should hear it sound. You must click the **Stop Test** button to stop the check.

Find DUT

Saving device information allows you to import the specific device information into the Target/Device emulator.

The Find DUT utility obtains all vendor-specific information and detailed device parameters.

Find device finds any devices that are attached to any port.

Select **Setup** on the main menu bar and choose **Find DUT**.

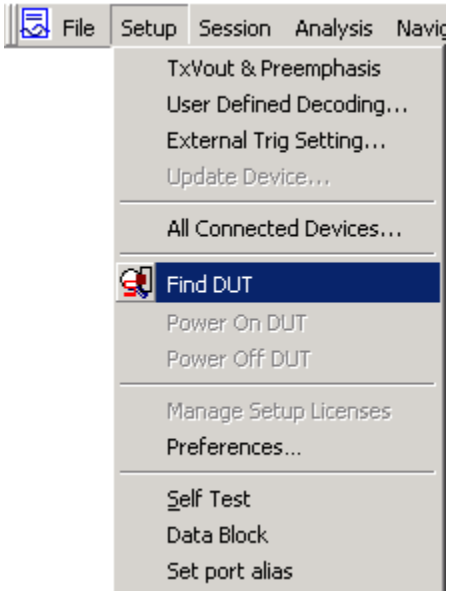


Figure 3.149: SATA: Find Device Command on Tools Menu

The Find DUT dialog opens. See following screen capture.

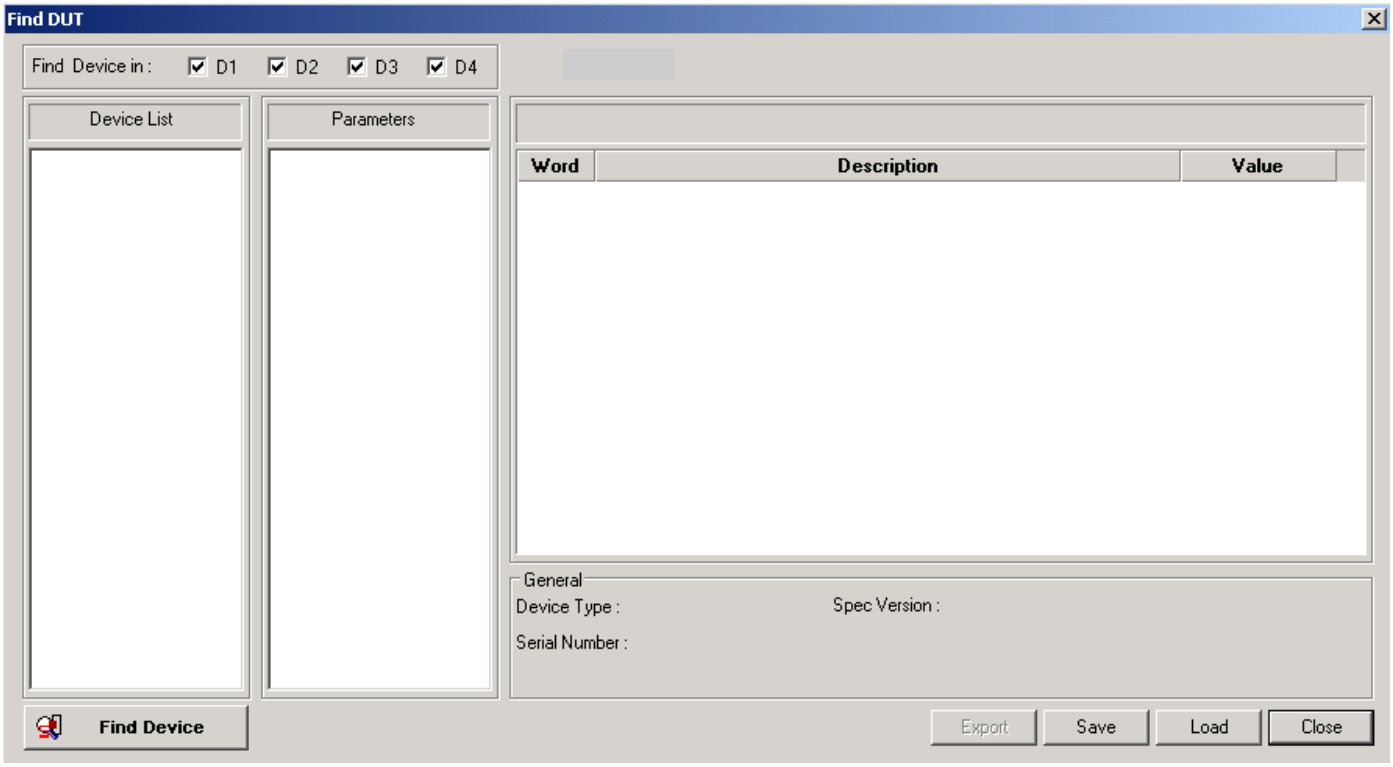


Figure 3.150: SAS: Device Identifier Dialog

Click the **Find Device** button to search for connected devices. After a brief period, the dialog displays all device information.

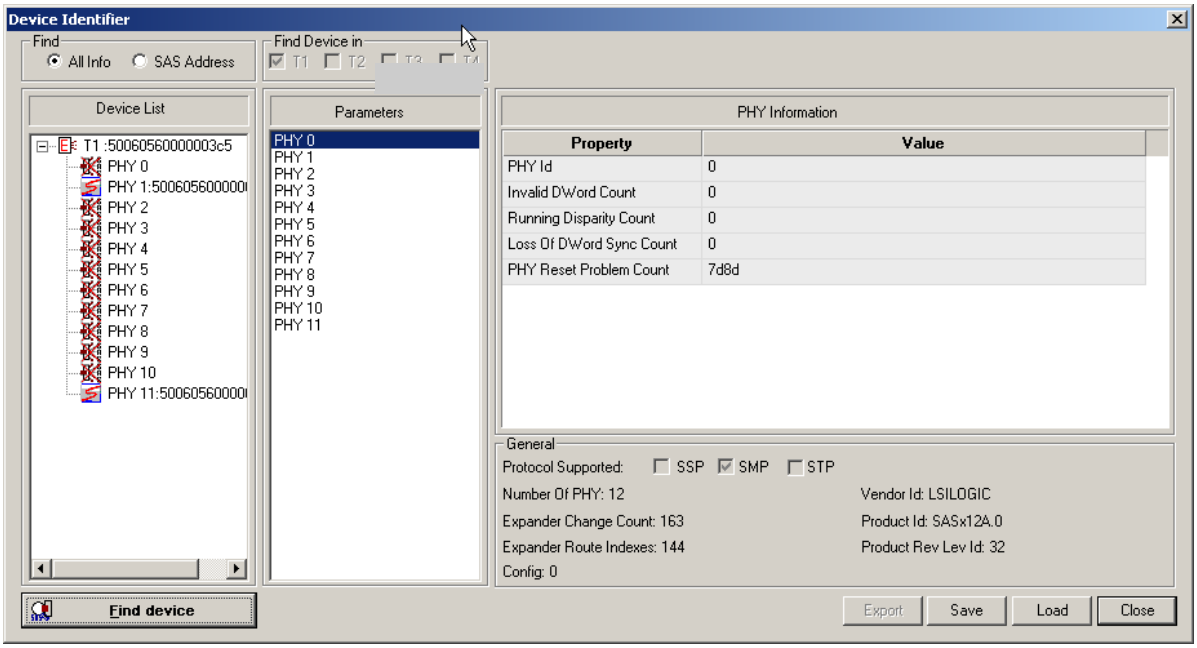


Figure 3.151: SAS: Identified Devices

Click a device in the Device List to display information about that device.

Aliasing

You can enter a 16-character alias name for a device. In the Device List, right-click the device name and enter an alias after the colon.

The alias name appears in the Device List.

Exporting

You can export a device specification to a text file. Click the **Export** button to open the Export dialog.

Compliance Test (SATA)

The Compliance Test consists of a set of selectable tests to verify compliance with the SATA specification. SATA compliance is at UTD Rev 1.4.

Note: The tests follow the LeCroy MOI, which is described in the **SATA_Digital-Device_MOI_LeCroy_1.00_UTD1.4.pdf** file in the installed Documents directory.

Note: You can start tests using the command line. The SAS/SATA Protocol Suite API Reference Manual, Section 2.12, starting on page 153, explains how to write VB scripts to automate compliance tests and generate results as RTF files.

To run a Compliance Test:

1. Select **Tools** on the main toolbar and choose **Compliance Test** to open the Compliance Test dialog.

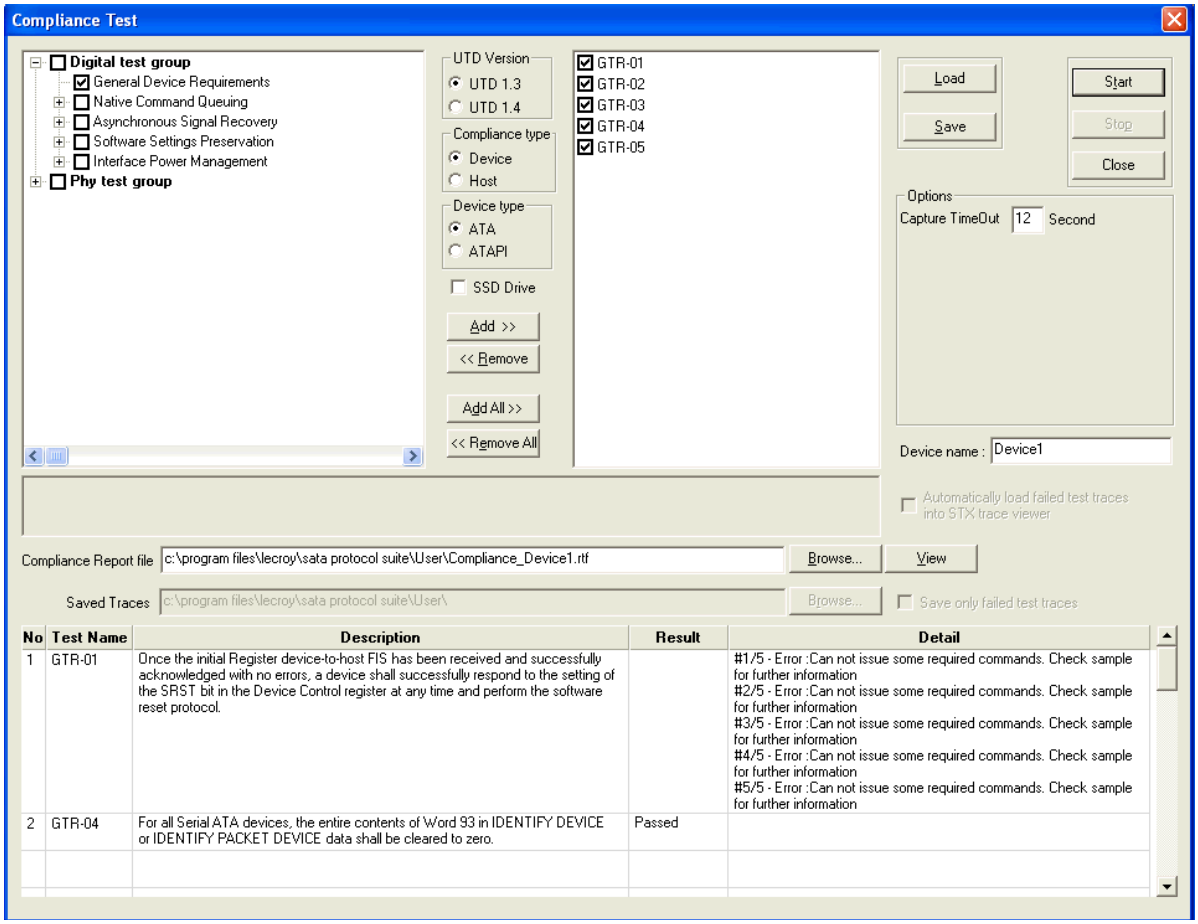

Compliance Test
Digital test group
General Device Requirements
Native Command Queuing
Asynchronous Signal Recovery
Software Settings Preservation
Interface Power Management
Phy test group
UTD Version
UTD 1.3
UTD 1.4
Compliance type
Device
Host
Device type
ATA
ATAPI
SSD Drive
Add >>
<< Remove
Add All >>
<< Remove All
GTR-01
GTR-02
GTR-03
GTR-04
GTR-05
Load
Save
Start
Stop
Close
Options
Capture TimeOut 12 Second
Device name : Device1
Automatically load failed test traces into STX trace viewer
Compliance Report file c:\program files\lecroy\sata protocol suite\User\Compliance_Device1.rtf
Browse...
View
Saved Traces c:\program files\lecroy\sata protocol suite\User\
Browse...
Save only failed test traces
No
Test Name
Description
Result
Detail
1
GTR-01
Once the initial Register device-to-host FIS has been received and successfully acknowledged with no errors, a device shall successfully respond to the setting of the SRST bit in the Device Control register at any time and perform the software reset protocol.
#1/5 - Error :Can not issue some required commands. Check sample for further information
#2/5 - Error :Can not issue some required commands. Check sample for further information
#3/5 - Error :Can not issue some required commands. Check sample for further information
#4/5 - Error :Can not issue some required commands. Check sample for further information
#5/5 - Error :Can not issue some required commands. Check sample for further information
2
GTR-04
For all Serial ATA devices, the entire contents of Word 93 in IDENTIFY DEVICE or IDENTIFY PACKET DEVICE data shall be cleared to zero.
Passed

Figure 3.152: SATA: Compliance Test Selection

The Digital Test Group has:

- **General Device Requirements**: GTR-01 through GTR-05
- **Native Command Queuing**: NCQ-01 through NCQ-05
- **Asynchronous Signal Recovery**: ASR-01 and ASR-02
- **Software Settings Preservation**: SSP-01 through SSP-12
- **Interface Power Management**: IPM-01 through IPM-11
- **Digital Optional Features**: DOF-01 and DOF-02

The PHY Test Group has tests OOB-03 through OOB-07.

2. Choose the tests in the left pane of the dialog and click the **Add>>** button.
3. Enter a value for **Capture Timeout**.

Note: If test running time exceeds the Capture Timeout value, the test terminates.

4. Enter the **Device Name**.
5. Select the UTD Version as **UTD 1.3** (for devices supporting up to SATA 2.6 specification) or **UTD 1.4** (for devices supporting up to SATA 3.0 specification).
6. Select the Compliance Type as **Host** or **Device**.
7. Select the Device Type as **ATA** or **ATAPI**.
8. When testing SSD devices, select the **SSD Drive** checkbox, to ensure correct test results.
9. To view failed test traces in the sample viewer, check the **Automatically load failed test traces into STX trace viewer** check box.
10. To save the failed test traces only, check the **Save only failed test traces** check box.
11. Enter a path and file name for the **Compliance Report file**, or use the default file name and path:
    C:\Program Files\LeCroy\SATA Protocol Suite\User\Compliance_Device1.rtf
12. Enter a path and file name for the **Saved Traces**, or use the default folder:
    C:\Program Files\LeCroy\SATA Protocol Suite\User\
13. After you select tests, click **Start**.
14. The test runs and, after a brief period, displays the result.

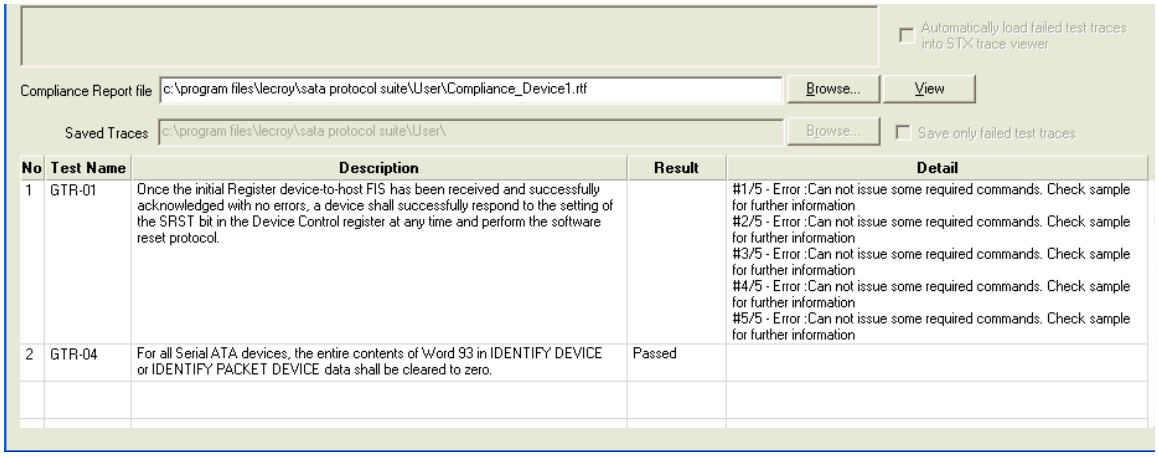

Automatically load failed test traces into STX trace viewer
Compliance Report file
c:\program files\lecroy\sata protocol suite\User\Compliance_Device1.rtf
Browse...
View
Saved Traces
c:\program files\lecroy\sata protocol suite\User\
Browse...
Save only failed test traces
No
Test Name
Description
Result
Detail
1
GTR-01
Once the initial Register device-to-host FIS has been received and successfully acknowledged with no errors, a device shall successfully respond to the setting of the SRST bit in the Device Control register at any time and perform the software reset protocol.
#1/5 - Error :Can not issue some required commands. Check sample for further information
#2/5 - Error :Can not issue some required commands. Check sample for further information
#3/5 - Error :Can not issue some required commands. Check sample for further information
#4/5 - Error :Can not issue some required commands. Check sample for further information
#5/5 - Error :Can not issue some required commands. Check sample for further information
2
GTR-04
For all Serial ATA devices, the entire contents of Word 93 in IDENTIFY DEVICE or IDENTIFY PACKET DEVICE data shall be cleared to zero.
Passed

Figure 3.153: Compliance Test Result

15. To save the current compliance setup for later use, click the **Save** button to open the Save As dialog. Assign a meaningful name to the setup and save it as a ***.cst** compliance file.
16. To run a previously defined setup, click the **Load** button and choose a previously defined setup to run.

Note: When you are running Compliance Test, do not connect the analyzer to the Host if testing a Device. Do not connect the analyzer to the Device if testing Host. Such improper connections can impact compliance-test result validity.

Chapter 4

InFusion Overview

The LeCroy InFusion™ Error Injector and Traffic Modifier is an error injector and traffic modification tool that allows you to verify real-world fault handling for Serial Attached SCSI (SAS) and Serial ATA (SATA) systems. InFusion can sit unobtrusively in the data path on a live system to programmatically alter or corrupt traffic. InFusion is the ideal tool for stress-testing systems using actual workloads.

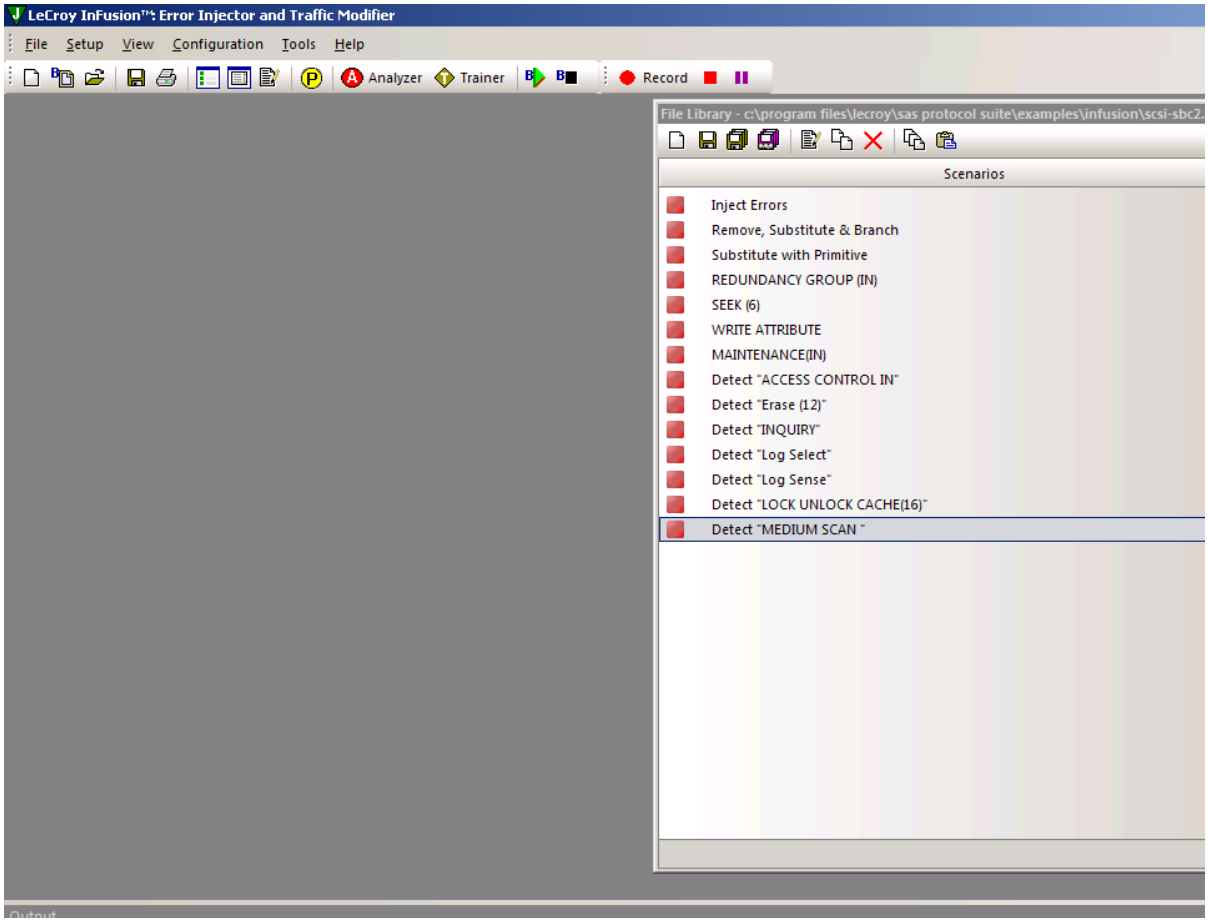


Figure 4.1: InFusion Windows

InFusion supports SAS SSP, SMP, STP, and SATA-based protocols operating across a single SAS or SATA link up to 6 G. InFusion monitors traffic from both directions in real-time and relies on predefined rules to replace any bit, primitive, or parameter with one you specify.

InFusion can change traffic when it detects a specific sequence or reaches a designated time interval, yet it requires no complicated scripts, programming, or simulation tools.

InFusion can monitor traffic in both directions and act on events occurring in either direction of the communications link. InFusion can modify traffic in only one direction within a given test scenario, but that direction can be either from the Initiator or from the Target.

InFusion is specifically designed to verify recovery characteristics within a subsystem. An easy pop-up menu interface allows you to create specific test scenarios in just minutes.

Once a InFusion session starts, the system automatically handles protocol handshaking between devices. InFusion transmits a faithful copy of the original data stream down to the CRC value which, if needed, it recalculates. InFusion allows test engineers to systematically verify error recovery in ways not possible with other test platforms.

An Infusion event can trigger an analyzer.

Infusion supports all commands in the SATA 3.0 specification.

Key Features

The key features of InFusion are:

- **Error Injection**: Injects CRC, disparity, 8b/10b encoding, framing, and coding errors.
- **Break Link Recovery**: Programmatically breaks the connection to test link recovery.
- **Value Replacement**: Monitors the link for specific values, patterns, or primitives (as low as bit level) and replace with user-defined values. You can replace values on every occurrence, after a specified number of occurrences, or after a specified time interval.
- **Packet Drop**: Removes individual primitives, address frames, or data frames from the stream to verify retry behavior.
- **Primitive Manipulation**: Replaces handshaking and flow control primitives to help validate robustness of a design.
- **Traffic Monitoring:** Operates as a traffic monitor, collecting statistical data on user-specified parameters. In this mode, data passes unchanged in both directions.
- **Menu-Driven Interface:** Allows easy set-up of test scenarios.
- **API based on C++:** Allows development of custom test applications.
- **Scenario Batch Files:** Allows scenario scripts.

With respect to traffic modification, in the Link Layer you can modify primitives, CRC, scrambled traffic, and SSP, SMP, and STP connection events. You cannot modify clock skew management, OOB and power management, and signal integrity.

InFusion consists of a hardware device that connects to the line under test and a Windows-based software application used to create and download test scripts to the device. You also can use the software application to configure and control the device across an Ethernet link.

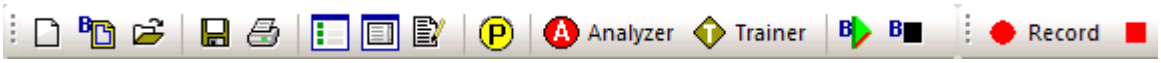
InFusion test scripts are called scenarios. Scenarios determine how the hardware device monitors and modifies line traffic. You must use the application to create and download scenarios.

For the InFusion connections, the device is connected between the SAS/SATA host and the PHY of the test target (DUT).

Interface

Buttons

The InFusion interface has the following command buttons:



New Scenario: Begins the scenario creation process by listing Scenario Name, Direction for traffic changes, and Global Rules in the scenario window.

New Batch Script: Starts a scenario batch file in Batch Script window.

Open Library: Lists the InFusion Library Files (**.infdb**), which contain the available scenarios, in an Open dialog.

Save: Saves the current scenario in the UserData folder.

Print: Prints the current scenario.

Show Library: Displays/hides the Main Library window (on the right), which displays the available scenarios. You can create a new scenario, save a selected scenario, save the library, save a copy of the library, display the selected scenario, insert a copy of the selected item, or delete the selected scenario.

Show Output: Displays/hides the Output window (at the bottom), which displays InFusion output. Use the buttons to save output, print output, display options (automatically save the log file, with a path and size), start logging, stop logging, and clear the Output window.

Show Device Library: Displays/hides the scenarios of the current device library.

Port Configuration: Displays the port configuration dialog. See “Port Configuration for InFusion” on page 240.

Show Analyzer: Returns to the Protocol Analyzer or Target/Host Emulator window.

Show Trainer: Goes to the Trainer window.

Run Batch Script: Runs a scenario batch file.

Stop Batch Script: Stops a running scenario batch file.

Rec Analyzer: Starts recording on the current analyzer, using the current project.

Stop: Stops recording on the current analyzer.

Abort: Aborts recording.

Menus

The InFusion interface has the following menus:

File (see command descriptions in the “Buttons” section above)

- New Scenario, Open Scenario (File Library or Main Library)
- Open an InFusion database (.**infdb** file)
- Launch Analyzer
- Launch Trainer
- New Batch Script, Save Batch Script As
- New Library, Close Library (File Library or Main Library), Save Library, Save Copy of Library As
- Open Log File
- Print Setup
- Recent Trace Files
- Recent Project Files
- Close

Setup

- External Trig Setting (see “External Trig Setting” on page 212)
- Update Sierra Device (see “Update Device” on page 213)
- All Connected Devices
- Status Bar

View

- Views (Library, Output, Customize; see window descriptions in “Buttons” section above)
- Smart Docking
- Toolbar
- Status Bar

Configuration

Port Configuration (see “Port Configuration for InFusion” on page 240)

Batch Script Setting (see “Scenario Batch Files” on page 287)

Tools

Browse UserData, System, or InFusion folder.

Help

Help Topics and About InFusion.

Main Library

You can **Show Main Library**.

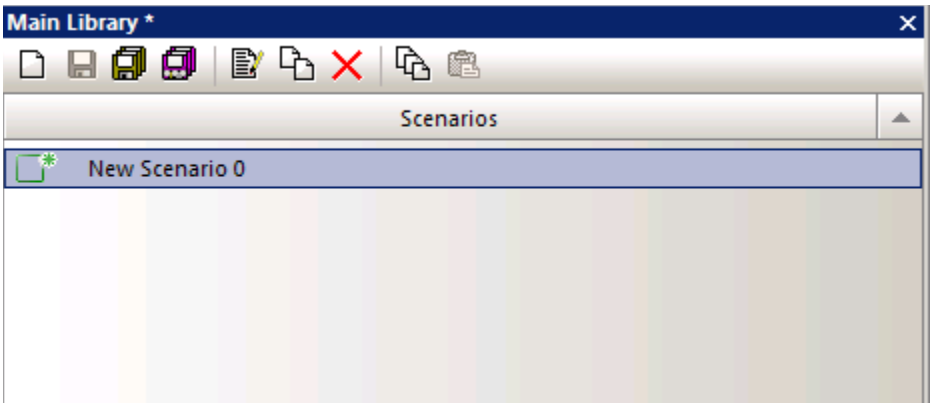


Figure 4.2: Main Library

The Main Library has Scenarios.

Using the buttons from left to right, you can:

- Create a new scenario and save a scenario.
- Save a library and save a copy of a library.
- View/edit a scenario, insert copy of a scenario and delete scenario.
- device ports.
- Copy and paste.

File Library

You can display the File Library.

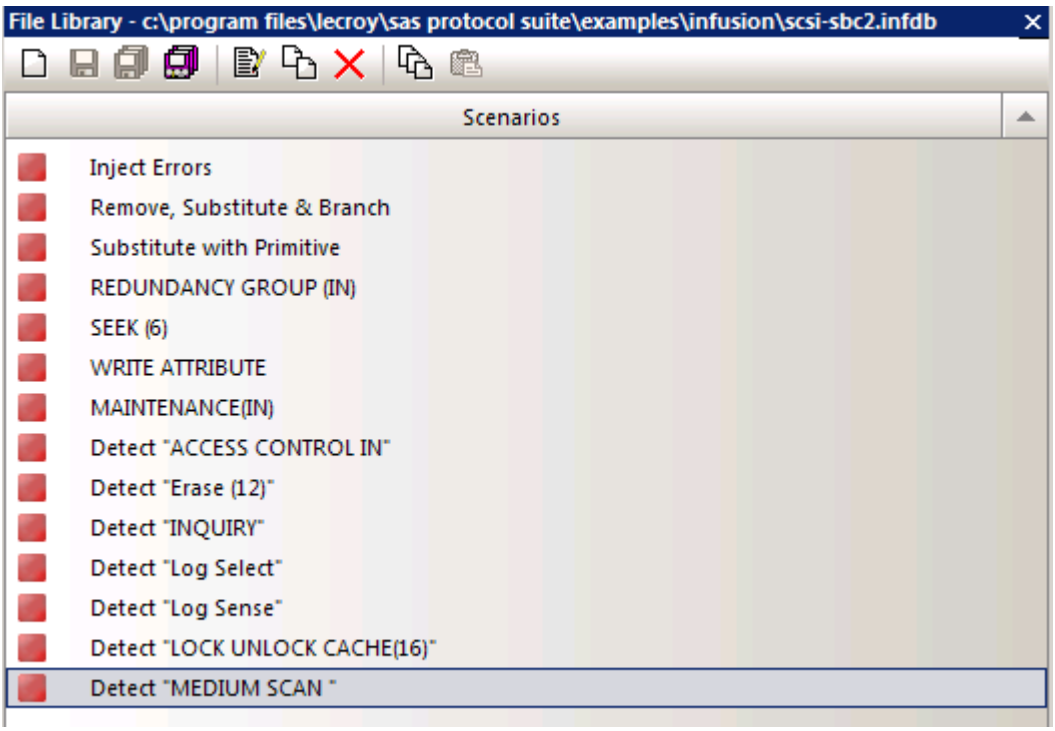


Figure 4.3: File Library

A File Library has Scenarios currently available in the device.

Using the buttons from left to right, you can:

- New scenario.
- Save selected scenario.
- Save library.
- Save a copy of the library as.
- View/edit a selected item.
- Insert a copy.
- Delete a selected scenario.
- Copy
- Paste

Device Ports

If a device is connected, the software displays the Device Ports.

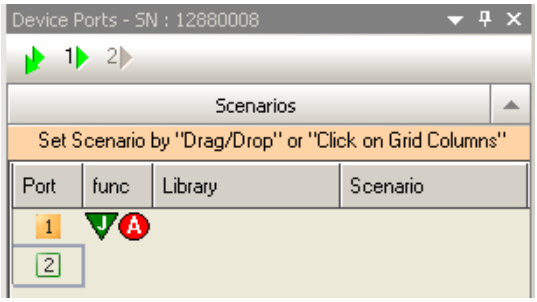


Figure 4.4: Device Ports

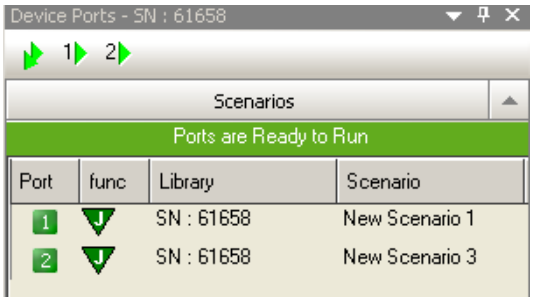
Using the first row of icons, you can Run/Stop All Ports or Run/Stop individual ports. The columns display the Port, Function/Configuration, Library, and Scenario. You can Float, Dock, Auto-Hide, or Hide the window.

Note: A port row is grayed-out when that port has not been configured to be a Jammer in the Port Configuration dialog (see "Port Configuration for InFusion" on page 240).

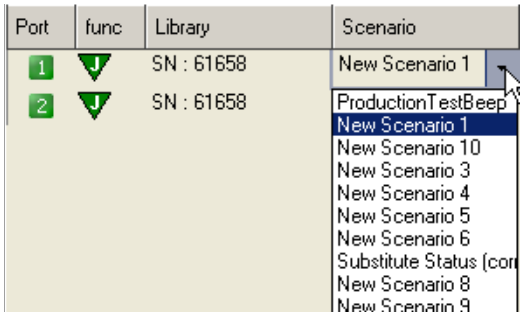
Using the Device Ports Dialog

After you have finished Port Configuration (see "Port Configuration for InFusion" on page 240), you use the Device Ports dialog to assign specific scenarios to ports, so that different scenarios can run on different ports.

To assign a scenario to a port, drag and drop the scenario from any library window to the port. The Device Ports dialog then displays the Library and Scenario on the row for that Port/Configuration.



Alternatively, assign the scenario using the Library and Scenario drop-down lists.



After you have assigned scenarios to ports, in the first row of icons, use the first green arrow icon to **Run/Stop All Ports**, or use the numbered green arrows to **Run/Stop an individual port**.

Note: A port row is grayed-out when that port is running a scenario.

Port Configuration for InFusion

The InFusion (Jammer) port configurations must match the Analyzer port configurations for the infusion-analyzer to work.

Select **Configuration > Port Configuration** to display the Set Port Configuration dialog.

To record traffic, select **Jammer** on the port that you want to jam. In the following figure, there is a match on Port 1.

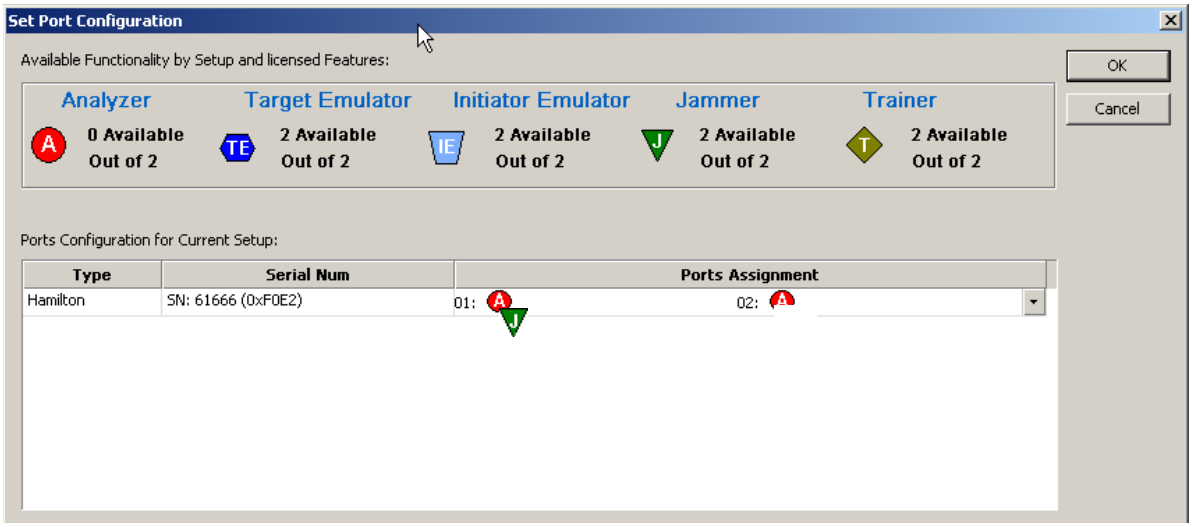


Figure 4.5: Ports Configuration Dialog with InFusion/Analyzer Port Match

Note: To display the current Port Configuration, click **Show Analyzer** to go to the analyzer application, then click the green button in the lower right corner to display the Port Status window (see "Port Status" on page 191).

InFusion Scenarios

You can create and execute InFusion scenarios. A scenario is a test script that defines how InFusion monitors and modifies line traffic.

Scenarios Overview

You create scenarios on a PC running the InFusion application. You then assign the scenarios for execution to a desired port on an InFusion device. You can also download up to ten scenarios to each InFusion device.

The InFusion application provides a menu-driven interface for building scenarios. The interface prompts you for simple decisions and choices from drop-down menus. As you make your selections, the script takes shape automatically in the scenario window. The script is in the form of simple English sentences. You need not understand any formal scripting language.

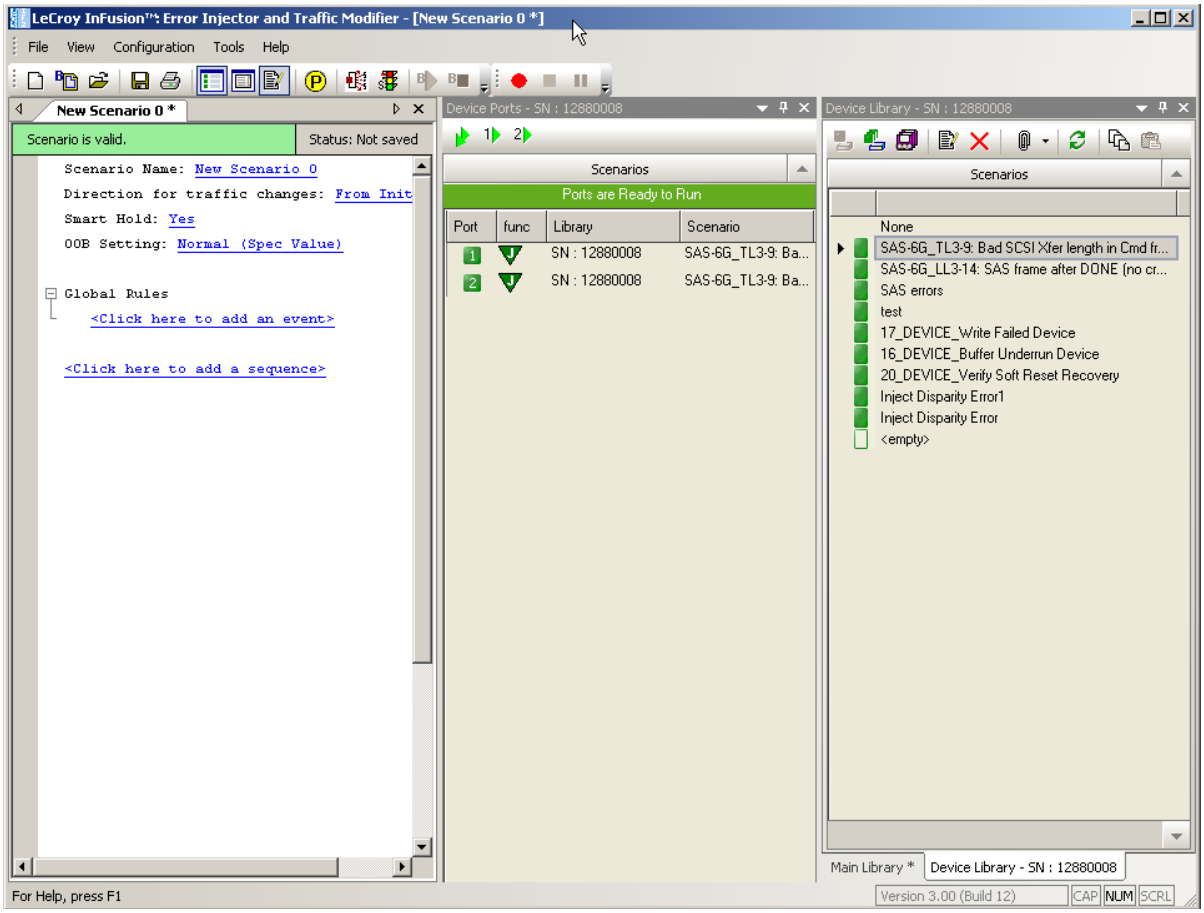


Figure 4.6: New Scenario in InFusion Window

InFusion Scenario Parameters

Timers

Timers allowed per state/sequence/scenario:

2 timers per state and 6 timers per scenario are allowed.

Events

Events allowed to be used per state/sequence/scenario:

For combined events, there is virtually no limit per state/sequence/scenario.

Actions

Actions allowed per state/sequence/scenario:

A maximum of 8 actions per state, 2048 actions per sequence (8*256 state), 4104 actions per scenario (2*2048 + 8 more in the Global Rules "state").

Monitors

Monitors allowed to be used per state/sequence/scenario:

InFusion can keep an account of 8/12 Monitor/Count events per scenario.

Random change of use of count and count randomly:

In Global Rules, if a Counter is used for Event counting, 2 extra actions are consumed. 2 more actions are required for "Every Nth occurrence" option.

In Sequences, If a Counter is used for Event counting, 3 extra actions are consumed. 3 more actions are required for "Every Nth occurrence" option.

Regarding limits on any of the above mentioned connections, i.e., x timers + y monitors are allowed per state where x+y=n:

There are a lot of big/small rules checked by the scenario compiler, but as a rule of thumb:

8 actions per state are available

12 counters globally are available, each assigned permanently to a certain job

6 available timers per scenario

12 programmable multi-purpose resources for DWORD comparison/substitution/capture are available. If a pattern detector uses 3 of these resources to trigger on a specific frame on the bus, only 9 more resources are available for other tasks. Frame/FIS type detectors are excluded from this rule, because they use their own dedicated resources.

8 primitive detectors are available

If you want to trigger on a pattern (Frame/FIS) and change/capture a dword(s) before the last offset of a detected pattern (e.g., changing the Frame Type of a SAS Frame with Data Offset == 11223344), you are limited to a maximum of 9 dword offset (i.e., if you trigger on the 20th payload of a Data FIS, you can change/capture the 12th dword onwards. 11th payload dword and preceding dwords are not accessible for change/capture)

You can not change a state based on back-to-back events. At 6G speed, there should be at least one dword between the triggering event of two consecutive states. At other speeds, back-to-back dword state transitions might rarely be missed, so best practice is to never assume back-to-back dword events.

As described later in this chapter, you can create any number of scenarios and store them in libraries on the PC hard drive. Scenario library files names are in the following format:

`<filename>.infdb`

Creating InFusion scenarios is easy, but it requires an understanding of the following terms defined in Table 1.

TABLE 4.1: Key Scenario Terms

Term	Definition
Action	InFusion response to an event.
Event	Condition that is detectable by InFusion.
Combined Event	Logical OR association of events (for example, event A OR event B).
Global Rules	Portion of a scenario that can define a single InFusion test state. You can think of the Global Rules and each sequence as a separate test routine or program operating within the scenario. Each operates independently and in parallel with the others. The purpose of each is to detect events and then respond with the appropriate action or set of actions. In essence, you can operate up to three test states simultaneously within InFusion.
Sequence	Portion of a scenario that can define multiple InFusion test states. More flexible than the Global Rules, a sequence allows more powerful scenarios that include branching and looping between test states (Global Rules can define only a single test state, so there is no branching).
State	“Behavior” of the Global Rules or a sequence at any point in time. In terms of InFusion testing, behavior is “waiting” for a set of events and responding with a set of actions.

Global Rules

Global Rules are a portion of the scenario that can define only one test state. To create the Global Rules, you use the menu-driven interface to enter an event or combined event and the corresponding action or set of actions (the response of InFusion hardware to the event).

In the case of a combined event, the action is taken upon occurrence of any of the events stated for the event combination. It is a logical OR association, meaning any of the events can trigger the action.

After you enter the event or combined event, the interface prompts you for actions. An action might be, for example, injecting a particular primitive or error into the traffic stream. You can enter multiple actions, which take place simultaneously.

After defining the event and actions within the Global Rule area, you can save the scenario and download it to a InFusion device.

Sequences

The Global Rules are all you need for simple test scenarios. However, a scenario also can contain one or two sequences, which can define multiple states and allow branching between states. With a sequence, you also can do looping, which allows you to repeat a test state or to execute a test for a specified period of time.

As with Global Rules, the menu-driven interface guides you in building a sequence. Some of the prompts are different, however, because you now are encapsulating groups of events and actions as distinct states. Recall that a state is a combination of events and actions at a specific point in time. If the event or combined event defined by a state occurs, the corresponding action or set of actions follows.

Figure 4.7: Global Rules and Sequence Areas of a Scenario

InFusion hardware provides the capacity to have up to two sequences co-existing in a scenario in addition to the Global Rules. Recall that both the Global Rules and any sequences are active at all times. Each is a separate “state machine,” having the behavior of a particular test state at any point in time. Because the Global Rules has the capacity for only one state, you can view it as a “degenerative state machine.”

Scenario Libraries

You can create any number of scenarios, which you then can archive on your PC hard drive. You also can download up to ten scenarios to each InFusion device for test execution. You can think of the libraries as windows that hold scenarios.

Recall that each library is a separate ***.infdb** file.

Main Library

When you launch the InFusion application, it opens a window called the Main Library. The main library is the default workspace for creating and storing new scenarios. The main library corresponds with the following file in the InFusion folder on the PC hard drive:

```
default.infdb
```

File Libraries

You can save the main library with a name other than default (while still using the **.infdb** file extension). The new file becomes a file library that is functionally equivalent to the main library with the following exception: It does not open by default in the Main Library window. You can navigate to other file libraries using the File Manager of the InFusion application.

In this manual, the main library and other **.infdb** file libraries are collectively called general libraries.

If you select **Open Library,** you see a window similar to the following:

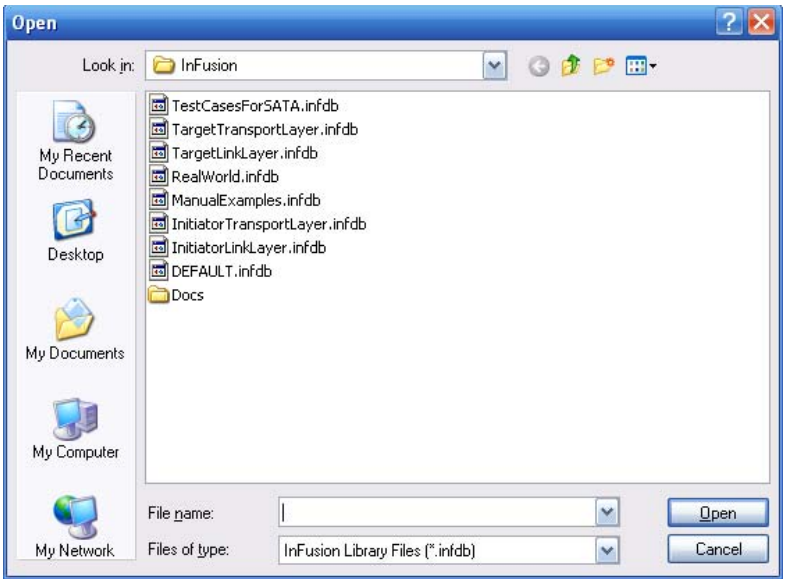


Figure 4.8: Open Library File List

By selecting the **TestCasesForSATA.infbd** file, you get an additional library window with predefined SATA test cases, similar to the following:

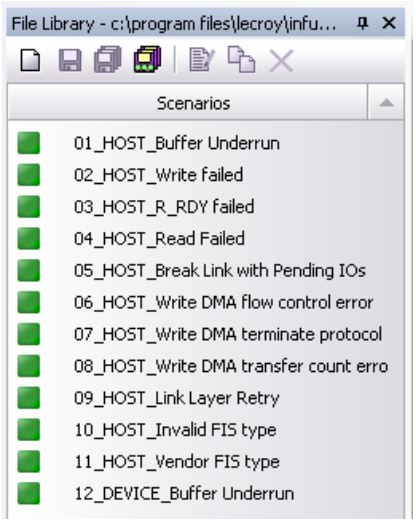


Figure 4.9: Test Cases for SATA Library

Device Libraries

In addition to general libraries, the application defines device libraries. Each device library is associated with a specific InFusion device. Each device library opens in a separate Device Library window and holds up to ten InFusion scenarios for the device. When you connect to the device and click the entry for that device in the Device List, the device library for the device opens automatically.

The scenarios that appear in the device library are those currently stored on the corresponding device. They were uploaded from the device to your PC when you opened the device library. You can click any of the scenarios listed to open it for editing. When you are finished with your edits, you can use the buttons on the Device Library toolbar to download the revised scenario to the device.

The None scenario is an empty and undefined scenario to allow you to assign port(s) to None.

The Multiport feature allows you to run a scenario by more than one port in a Device Library and to assign different ports to different scenarios and run them together. Each scenario in a library can run by more than one port.

Scenario Properties

To begin the scenario creation process, you click the **New Scenario** button in a library window or on the InFusion application toolbar. As the first step in creating a scenario, the application prompts you for scenario name, a short description (optional), and the direction of traffic to which any traffic changes apply. Changes are, for example, injection or removal of data or a primitive.

You identify direction of traffic change, or modification, in terms of traffic origin. The application uses the following conventions:

- **From Initiator**: Change is made to traffic coming from test host (for example, CRC error is injected into traffic stream sent from initiator to target).
- **From Target**: Modification is made to traffic coming from the target (for example, CRC error is injected into traffic stream sent from target to initiator).

The figure shows the first prompt in the scenario creation process (Figure 4.10 on page 247).

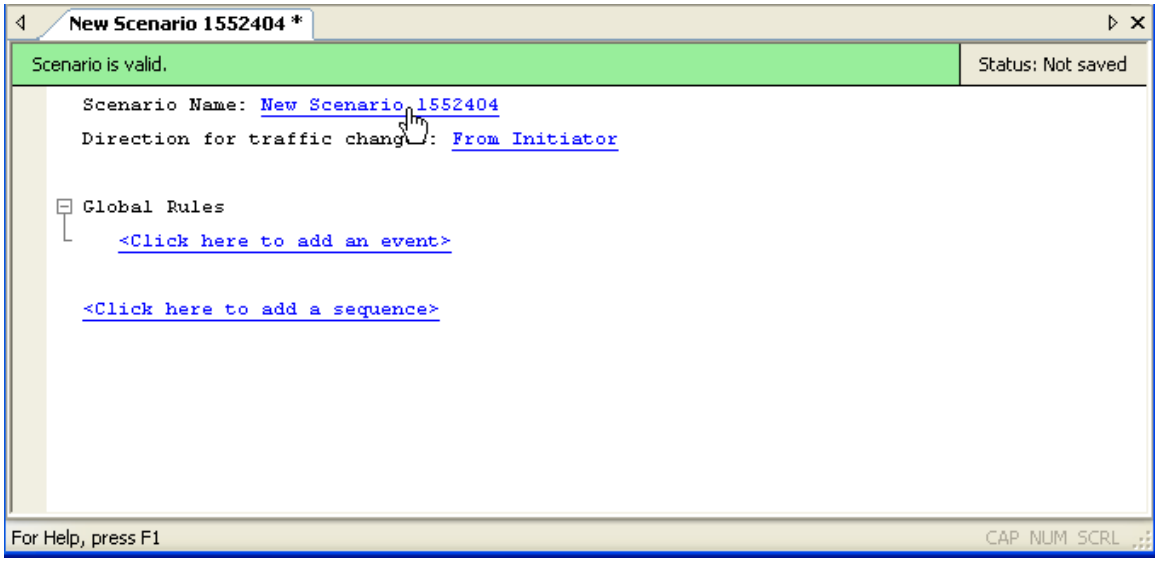


Figure 4.10: Entering Basic Scenario Information

To copy an event or action, right-click on the event or action and select **Copy**. Right-click **Click here to add another event** or **Click here to add an action** and then select **Paste**.

To copy a sequence or state, right-click on the sequence or state and select **Copy**. Right-click **Click here to add another sequence** or **Click here to add another state** and then select **Paste**.

You can also cut, delete, and edit a selected sequence, state, event, or action.

When you click the Scenario Name or the Direction For Traffic Changes, the Scenario Properties dialog box displays (see Figure 4.11 on page 248), allowing you to enter the scenario name, a short description, and direction of traffic change.

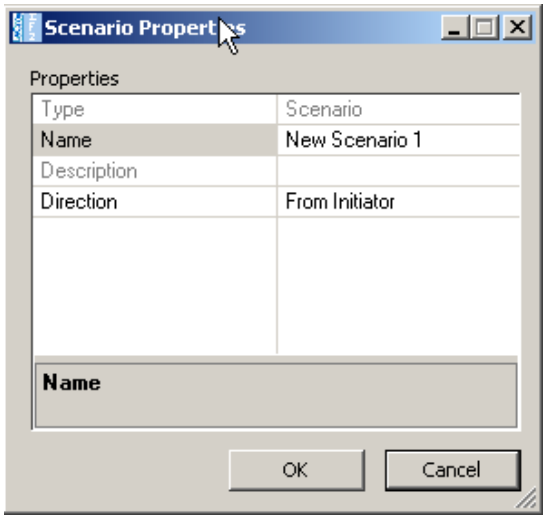


Figure 4.11: Scenario Properties Dialog Box

In the Scenario Properties screen, the direction for traffic modification is defined on a global basis for the entire scenario. In other words, any scenario action that modifies line traffic only affects the traffic flowing in the direction established at the top of the scenario, in the Scenario Properties. Scenario events can be monitored in either direction, and therefore the parameters for events provide the ability to specify the intended direction for monitoring traffic for that event.

SATA Smart Hold Option

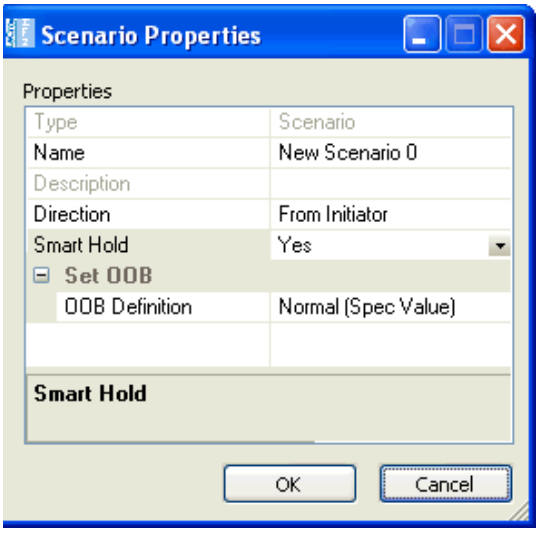


Figure 4.12: SATA Scenario Properties Dialog Box

SATA Scenario Properties have a Smart Hold option, which is on by default.

Each port monitors incoming data, which originated with the other device's receiver, as close as possible to where it enters the bus engine. If a port detects a HOLD primitive during a SATA frame, the port stops reading data from the FIFO and generates HOLDA. The HOLD propagates through the bus engine and eventually goes to the other device, where the HOLD causes the other device to send HOLDA. (The bus engine FIFOs must be deep enough to hold all the traffic that the other device sends while the HOLD propagates. The port drops all incoming HOLDA conditions, so HOLDAs are never put in the FIFOs or made visible to the sequencers.)

After this, the port that had been receiving the HOLD stops sending HOLDA and attempts to read data from the FIFO. The termination of HOLD propagates through the bus engine and then causes the other device to restart transmission, which puts data into the FIFO.

Note: If both sides send HOLD primitives that overlap, the receivers drop the HOLD conditions to avoid overflowing the FIFOs. If you turn off the Smart Hold option, the port does not send HOLDA when it detects a HOLD primitive during a SATA frame.

Scenario Events

A scenario is a script you create using simple mouse clicks and text entries. As you work, the script takes shape in the scenario area of the application display. You can think of the scenario area itself as consisting of two subareas: A Global Rules area at the top, where you create the Global Rules, and a Sequence area beneath the Global Rules, where you create any sequences. Whether you are creating Global Rules or a Sequence, the menu-driven interface prompts you to specify the event(s) for which you want to trigger actions.

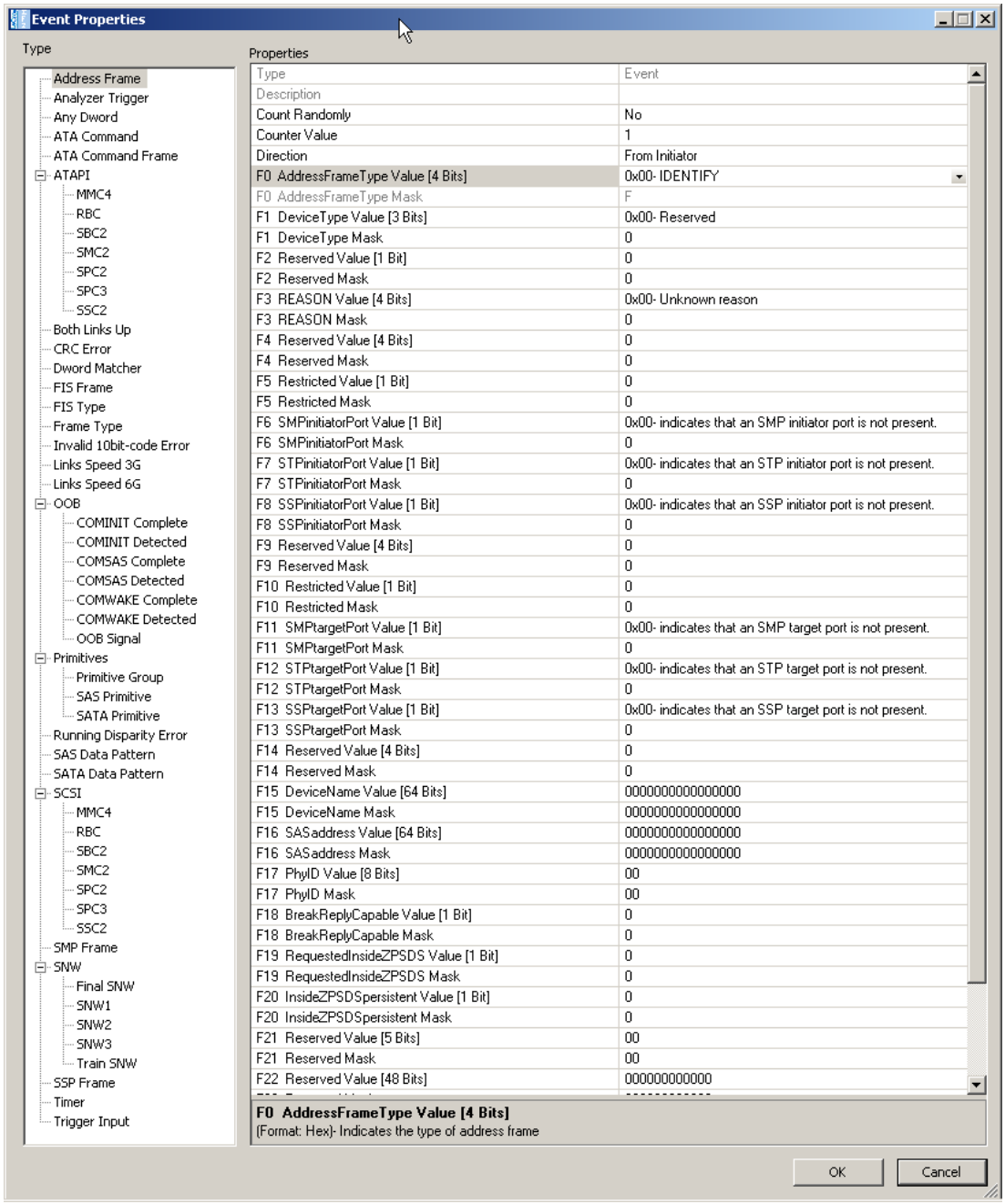


Figure 4.13: Event Properties Dialog

While many events are line conditions, an event also can be a condition that occurs within a InFusion device (for example, detection of a trigger signal from another device).
The following table lists supported events. Note that some events are applicable only in the context of creating sequences (those events appear on the drop-down list only if you are creating a sequence). Sequences can have multiple states, and they allow branching between states.

TABLE 4.2: Events

Event	Description
Address Frame	Occurrence of a specified address frame.
Analyzer Trigger	Trigger on Analyzer when its event matches. You can see the trigger on the Status Bar, but the Port Status dialog does not display any mark in the Trigger column. **Note**: This is different than the external trigger mechanism. You do not need an external trigger cable. **Note**: When the analyzer triggers, it triggers on a packet before the actual trigger event occurs. The trace triggers more than 1us before the event actually occurs. The trigger is on the Initator side instead of the Target side as set in the scenario.
Any DWORD	Occurrence of any DWORD.
ATA Command	Occurrence of a particular ATA command.
ATA Command Frame	Occurrence of a particular ATA command frame.
[+] ATAPI	Occurrence of a particular ATAPI command from the list: MMC4, RBC, SBC2, SMC2, SPC2, SPC3, or SSC2.
Both Links Up	Occurrence of both line ports active (not idling).
CRC Error	Occurrence of a CRC error.
DWORD Matcher	Occurrence of a particular DWORD.
FIS Frame	Occurrence of a particular FIS frame.
FIS Type	Occurrence of a particular SATA FIS type.
Frame Type	Occurrence of a particular frame type.
Invalid 10bit-code Error	Occurrence of an invalid 10b code.
Links Speed 3G	Both lines operating at 3 Gbps.
Links Speed 6G	Both lines operating at 6 Gbps.
OOB Signal	Occurrence of OOB signal.
[+] Primitives	Occurrence of Primitive Group, SAS Primitive, or SATA Primitive.
Running Disparity Error	Occurrence of Running Disparity (RD) error.
SAS Data Pattern	Occurrence of a particular data pattern in a SAS frame.
SATA Data Pattern	Occurrence of a particular data pattern in a SATA frame.
{+} SCSI	Occurrence of a particular SCSI command from the list: MMC4, RBC, SBC2, SMC2, SPC2, SPC3, or SSC2.
SMP Frame	Occurrence of a particular SMP frame.
SNW	Occurrence of Final SNW, SNW1, SNW2, SNW3, Train SNW
SSP Frame	Occurrence of a particular SSP frame.
Timer	Occurrence of a particular elapsed time (time period).
Trigger Input	Occurrence of input trigger.

The following sections provide some additional details about three of the above events.

DWORD Matcher

DWORD Matcher is a DWORD pattern matcher that presents match and mask fields and a K-Code Mask field. K-Codes are control characters that are always used in the first byte of a four-byte primitive. Of the K-Code masks listed in the menu, D-D-D-D is used for data bytes, and K-D-D-D is used for all primitives.

When you create a DWORD match, keep the following in mind:

- The pattern can be inside or outside of frames (it does not matter if the pattern is inside a frame or not).
- Because the pattern can be inside or outside of frames, there is no offset.
- You can make user-defined primitives. (This is the reason this feature was created.)
- You can use any K/D pattern.

SAS Data Pattern

- When you create a SAS data pattern, keep the following in mind:
- The pattern must be defined inside a frame that starts with a SOF or SOAF.
- The pattern must be data only (no K-codes/primitives).
- The pattern must be defined at a specific offset in the frame.
- The pattern and mask must be specified in the same format as specified in the SAS standard:
  0x12345678 (hex)
  where “1” is the first digit on the cable and is the MSB as given in the SAS Standard.

For example, for an SMP Request:

```
Pattern: 0x40000000
Mask: 0xFF000000
Offset: 0
SOF Type: SOF
```

SATA Data Pattern

When you create a SATA data pattern, keep the following in mind:

- The pattern must be defined inside a frame that starts with a SATA_SOF.
- The pattern must be data only (no K-codes/primitives).
- The pattern must be defined at a specific offset in the frame.
- The pattern and mask must be specified in the same format as specified in the SATA Standard.

For example, for Register H -> D FIS:

```
Pattern: 0x00000027
Mask: 0x000000FF
Offset: 0
SOF Type: SATA_SOF
```

Scenario Actions

After you enter the set of events for a test state, the menu-driven interface prompts you for the corresponding action or set of actions. If you define multiple actions, the actions occur simultaneously.

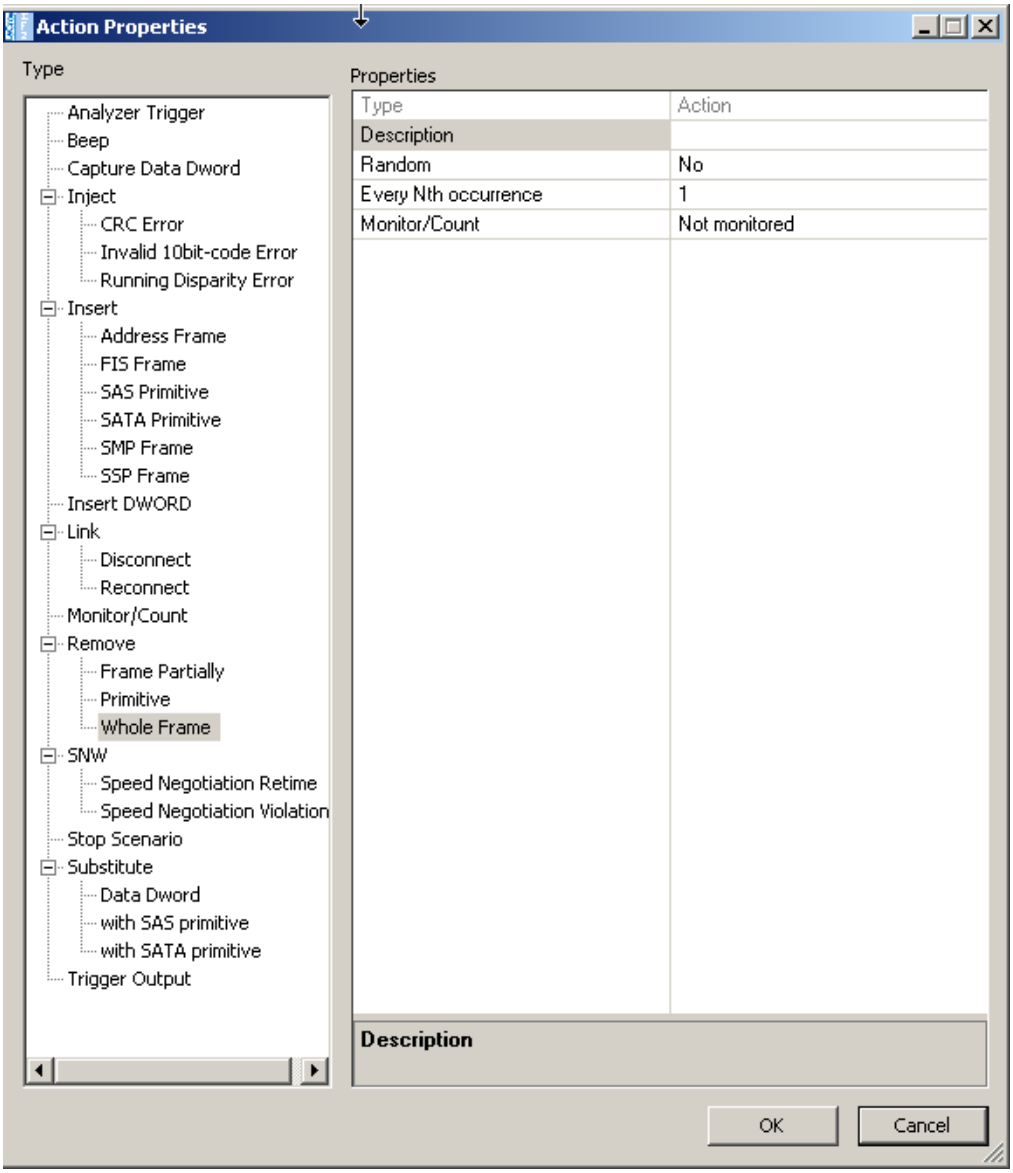


Figure 4.14: Action Properties Dialog

The following table lists supported actions. Note that some of these actions only apply to creating sequences.

TABLE 4.3: Test State Actions

Action		Description
Beep		Emits audible sound of duration. Select via drop-down list.
Branch to	Existing State[1]	Go to a state in this sequence that is already defined.[1]
	New State[1]	Go to a state in this sequence that is not yet defined (you need to define it).[1]
Capture Data DWORD		Captures a data DWORD into one of four registers.
Inject	CRC Error	Injects a CRC error into the line.
	Invalid 10bit-code Error	Injects invalid 10b code into the line.
	Running Disparity Error	Injects a Running Disparity (RD) error into traffic.
Insert	Address Frame FIS Frame SAS Primitive SMP Frame SSP Frame	Inserts a frame or primitive.
Insert DWORD		Inserts DWORD.
Link	Disconnect	Puts both InFusion SAS ports at electrical idle immediately.
	Reconnect	Starts traffic pass-through immediately. This action restarts traffic after a previous disconnect command. Once traffic is passing through, the initiator and target resume OOB signaling.
Monitor/Count		Opens a window to count the number of events that occur during a session. A session is a time interval during which a scenario runs.
Remove	Frame Partially Primitive Whole Frame	Removes the targeted event from the traffic.
Restart	All Sequences[1]	Restart all sequences in the scenario.[1]
	Current Sequence[1]	Restart the sequence that contains this action definition. [1]
SNW	Speed Negotiation Retime	Set RCDT, SNTT, ALT/TLT, TX speed, TRAIN/TRAIN_DONE pattern, and/or PHY Capability.
	Speed Negotiation Violation	Set Violation Type.
Stop Scenario		Stops all scenario activity.
Substitute	Data DWORD	Substitutes a data DWORD in the traffic.
	with SAS Primitive	Substitutes a SAS primitive in the traffic.
	with SATA Primitive	Substitutes a SATA primitive in the traffic.
Trigger Output		Sends a signal out the trigger port to the device downstream.

[1] Only shown in Action Properties dialog box when creating a sequence.

Using Counters in Events and Actions

Many of the events and actions supported by InFusion also support counters that can control functions.

Within events, counters determine how many times the event must occur before the associated actions are triggered. Event counters typically have two properties:

- **Count Randomly**: Can be set to “Yes” or “No” (default value is “No”).
  If set to “Yes”, the event repeats a random number of times (between 1 and the value set in the property **Max Random Count**, which replaces the property **Counter Value** when “Yes” is selected), before the action is triggered.
- **Counter Value**: Number of repeats required when **Count Randomly** is set to “No”. The default value is 1.

Within actions, counters determine how many times the system calls the action before it acts. Action counters typically have two properties:

- **Random**: Can be set to “Yes” or “No” (default value is “No”).
  If set to “Yes”, the action triggers a number of occurrences before the action takes place. That number ranges randomly between 1 and the value set in the property **At least every Nth occurrence**, which replaces the property **Every Nth occurrence** when “Yes” is selected.
- **Every Nth occurrence**: Number of times the system calls the action before it acts.

Note that there is some overlap in the way these counters can be used. For example, in the simple case of a single event leading to a single action, it makes no difference whether you specify the event to require five repeats before triggering the action, or the action to require five occurrences before it acts.

However, in the case of combined events and/or actions, the separate counters provide flexibility in designing test cases. For example, consider the case where Event_1 OR Event_2 leads to Action. If Event_1 has a counter of 5, then the Action triggers either when Event_1 has repeated five times or when Event_2 happens the first time, whichever occurs first.

But if the event counters are set to 1 and the Action counter is set to 5, then the Action happens after five occurrences of EITHER Event_1 or Event_2.

Capturing a Data DWORD

InFusion provides the ability to capture individual data DWORDs and provides four different registers to store captured DWORDs (DWORD #0, #1, #2 and #3).

To capture a data DWORD, select **Capture Data DWORD** from the Action Properties screen, as shown below. Select the register to be used to store the DWORD from the drop-down menu under the **Capture Register** property.

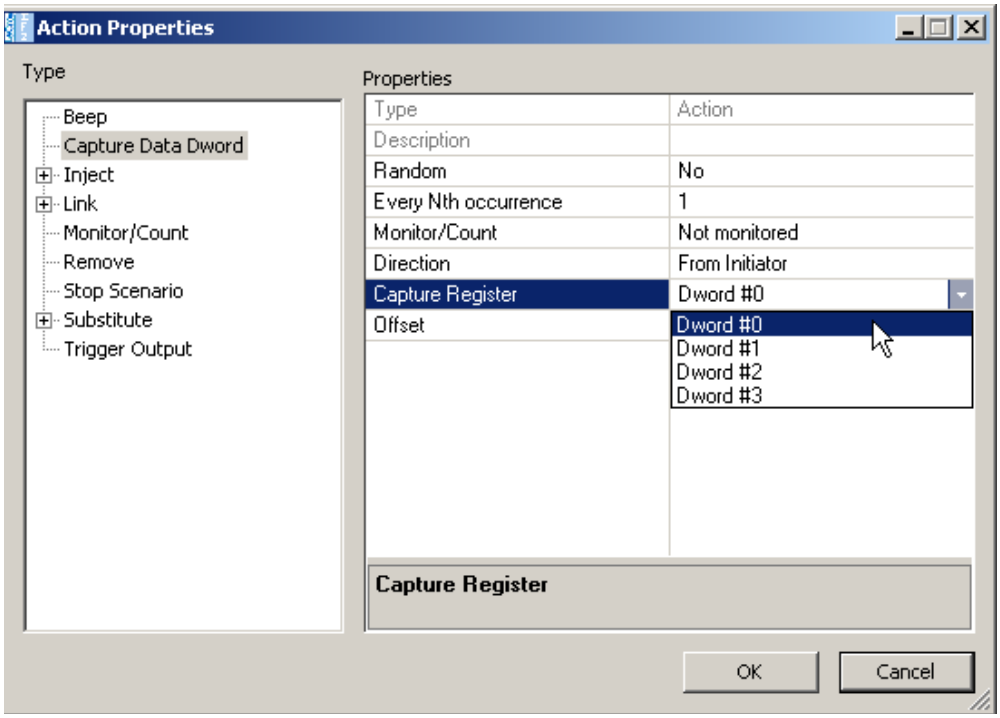


Figure 4.15: Capture Data DWORD Action

Using Captured Data DWORDs

Captured data DWORDs can be used in creating events for data that match the captured DWORD(s), or in creating actions to substitute the captured DWORD(s) into the data stream.

To create an event using the captured DWORD, in the Event Properties menu, select **SAS Data Pattern** (or **SATA Data Pattern**), and then select any of the 12 DWORDs (**DWORD 0 Type** through **DWORD 11 Type**). The drop-down menu provides the choice of a custom DWORD or any of the four captured DWORDs. If you select a captured DWORD, the **Value** field beneath this selection is hidden (the **Value** field is only used for specifying custom DWORDs). Note that choice of a mask and an offset are still available when using captured DWORDs.

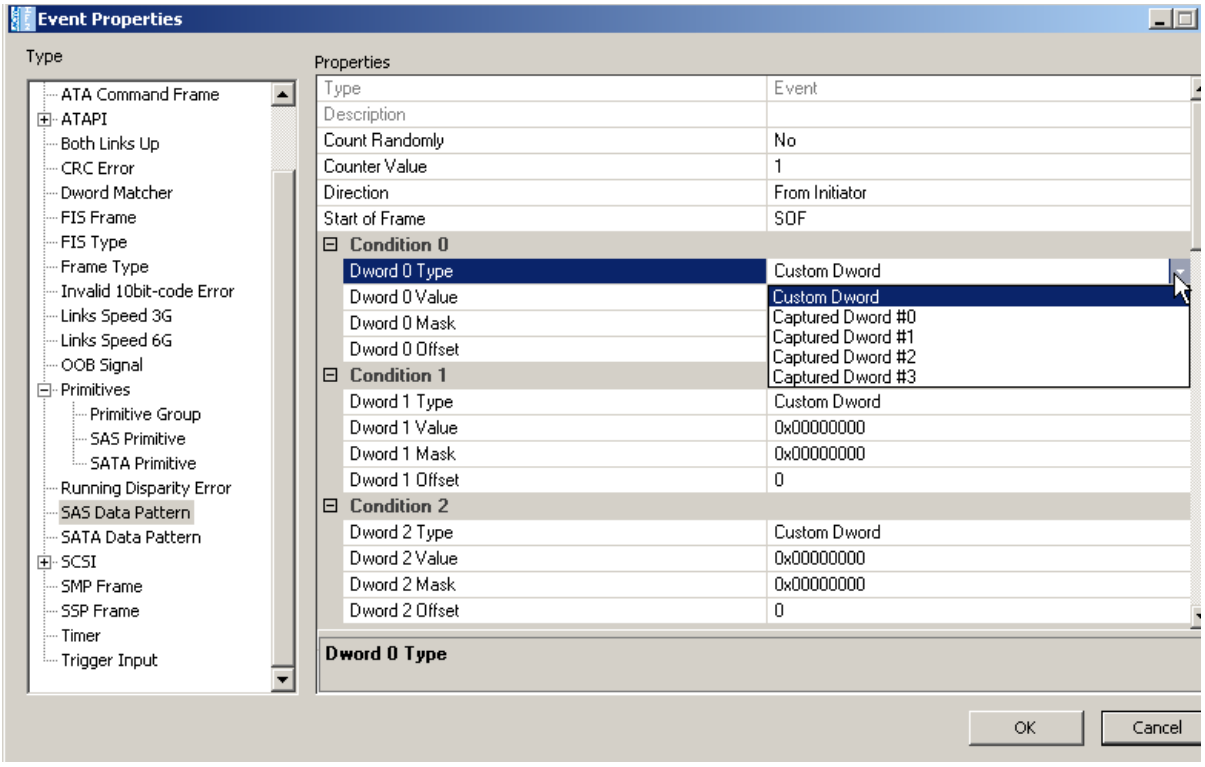


Figure 4.16: Using a Captured DWORD in a SAS Data Pattern

Captured data DWORDs may also be used in the **Substitute Data DWORD** test state action. From the Action Properties screen, choose **Substitute Data DWORD** and then select the **Substitute for** property. A drop-down menu is provided (see below) that allows the choice of a custom DWORD or any of the four captured DWORD registers.

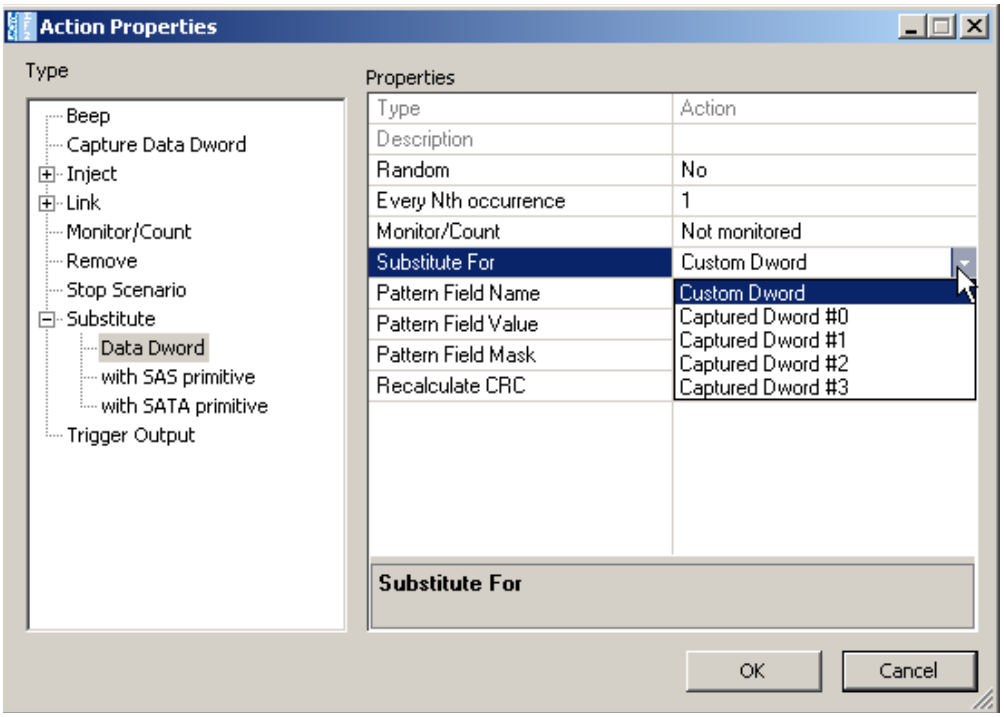


Figure 4.17: Using a Captured Data DWORD in Substitute DWORD Test Action

Summary of Scenario Creation

The suggested process of creating and executing a scenario is as follows:

1. Create a scenario in the main library.
2. Copy the scenario from main library to a device library by drag-and-drop with a mouse. (Each device library is associated with a specific InFusion device.)
3. Download all scenarios in the device library to a InFusion device.
4. Select the scenario in the device library that you want to run on the device.
5. To run the scenario, click the **Start Scenario** button from the Device Library toolbar. The device starts to monitor/modify traffic.

Note: Step 1 is described in detail for each example in following sections. Steps 2 to 5 are described in detail at the end of this chapter.

Creating Global Rules

This section gives examples for creating the Global Rules area of a scenario. Recall that the Global Rules area defines a single test state. The Global Rules do not have the capacity for multiple states, so that area of a scenario cannot change state.

In terms of InFusion testing, a state defines test “behavior.” In this context, behavior is “waiting” for an event and responding with an action or set of actions that happen simultaneously.

Keep in mind that a test state you implement with the Global Rules operates in parallel with the active test state of each sequence in the scenario.

In effect, InFusion lets you do up to three line tests at the same time. You can do one test with the Global Rules and a separate test with each sequence you create. You can have up to two sequences in a scenario.

The following table summarizes the Global Rules examples that follow.

TABLE 4.4: Global Rules Examples

Example	Description
1	Creating a single event and action (removes a primitive).
2	Creating a single event and action (replaces a primitive).
3	Creating a combined event (a logical OR association of multiple events) and an action.
4	Creating multiple triggers and actions.
5	Creating multiple actions on a single event.
6	Using timers.

Example 1: Creating a Single Event and Action that Removes a Primitive

In this example, the Global Rules area of the scenario waits for each RRDY Normal primitive from the initiator and removes it.

1. Click the **New Scenario** button in the main library or one of the device libraries.
2. In the Scenario Properties dialog, enter the scenario name, description, and direction of traffic change (see Figure 4.11 on page 248).
3. In the Global Rules area, click the prompt to **add an event**.

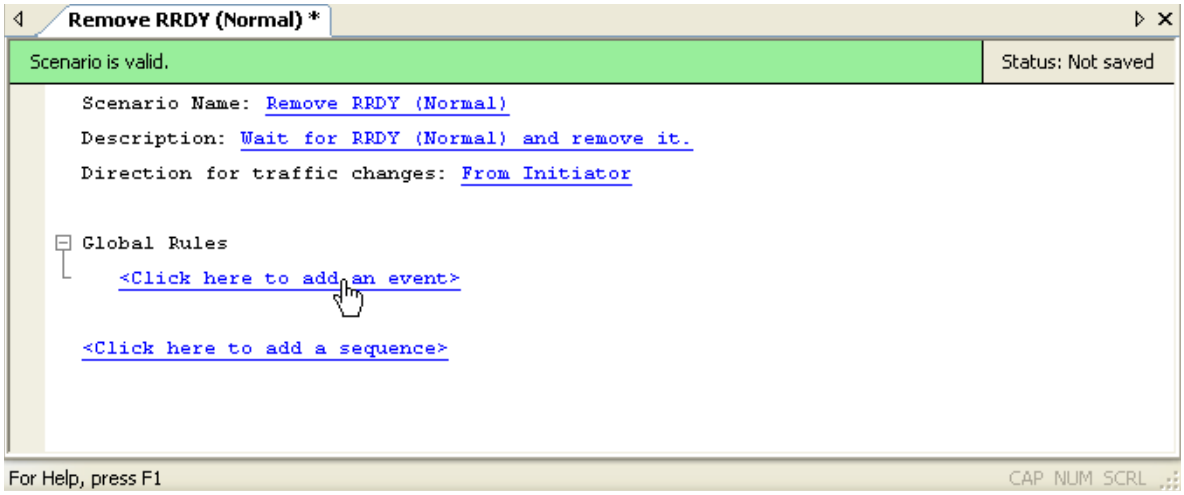


Figure 4.18: Example 1: Adding an Event

The Event Properties dialog box appears (see Figure 4.13 on page 250).

4. In the Type column of the Event Properties dialog, choose **Primitive > SAS Primitive**.
5. In the Type column in the middle of the dialog box, click **Description** if you want to add a description of the event.
6. Click **Direction** to choose the direction of traffic to monitor for the selected event (the default is **From Initiator**, which is what you want for this example).

7. Still in the middle column of the Event Properties dialog box, click **Primitive** to display a drop-down menu that lets you choose the type of primitive for which you want to wait in this scenario. In this example, it is **RRDY (Normal)**.

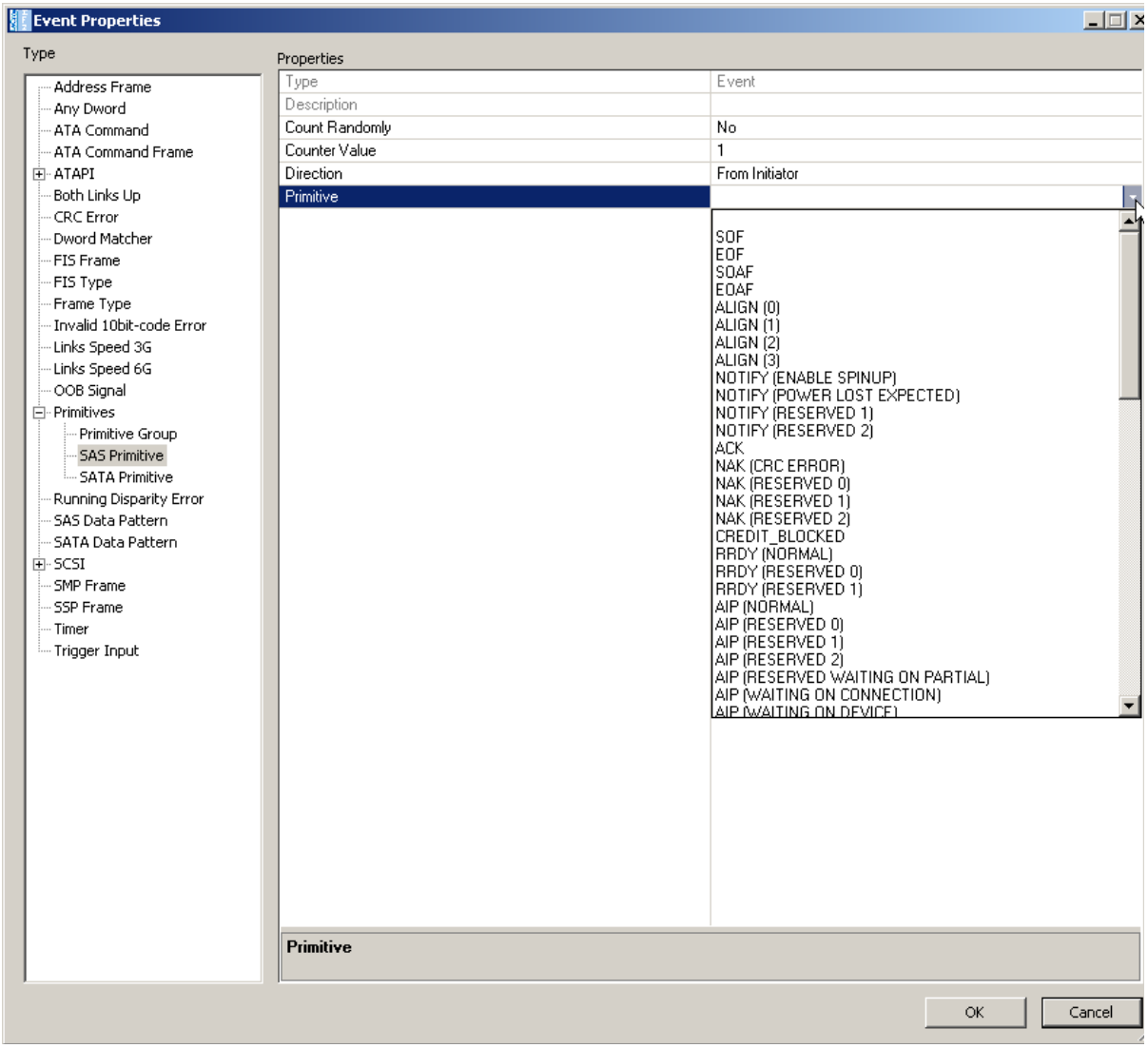


Figure 4.19: Example 1: Event Drop-Down List

8. Click **OK** to close the Event Properties dialog box.

9. In the Global Rules area, click the prompt to **add an action**.

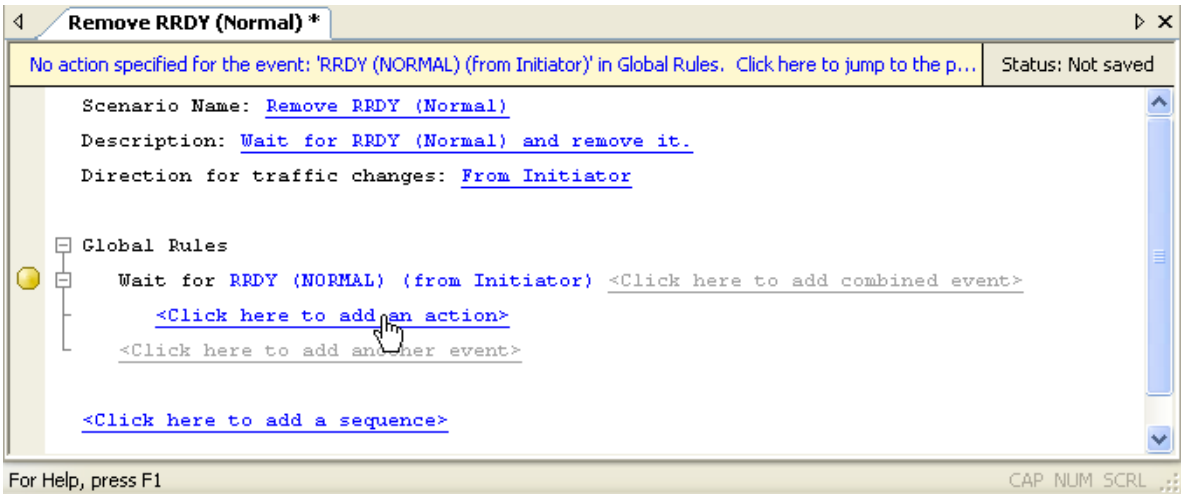


Figure 4.20: Example 1: Entering an Action

The Action Properties dialog box appears (see Figure 4.14 on page 254).

10. In the Type column on the left, choose the action that you want to occur when an RRDY is detected. In this example, it is the **Remove Primitive** action. Select Random **Yes** or **No**, **N** for Every Nth occurrence, and Monitor/Count as **Monitored** or **Not Monitored**.
11. Click **OK** to close the Action Properties dialog box.

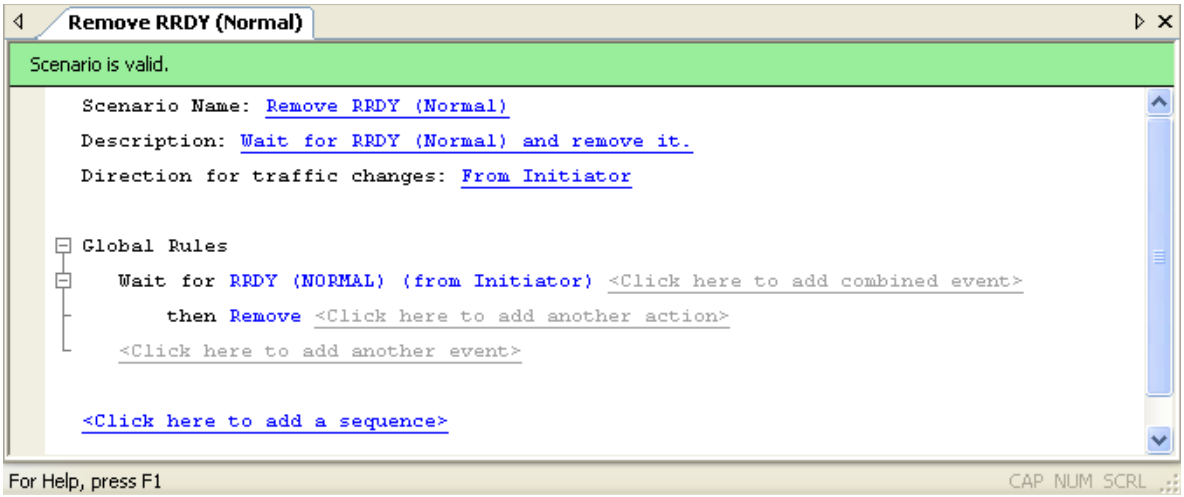


Figure 4.21: Example1: Complete Scenario

12. In the File menu, select **Save Scenario** to save the scenario.

Example 2: Wait for a Primitive and Replace It with an Error

In this example, the Global Rules portion of the scenario waits for each RRDY Normal primitive and replaces it with an ERROR primitive.

1. Click the **New Scenario** button in the main library or one of the device libraries. In the Scenario Properties dialog, enter the scenario name, description, and direction of traffic change.
2. In the Global Rules area, click the prompt to **add an event** to display the Event Properties dialog box.
3. As you did in the previous example, choose **RRDY (Normal)** as the type of primitive to monitor.
4. In the Global Rules area, click the prompt to **add an action** to display the Action Properties dialog box.
5. In the Type column on the left, choose **Substitute > with SAS Primitive** as the action that you want when an RRDY (Normal) occurs.
6. In the middle column of the dialog box, click **Description** if you want to add a description of the action.
7. Still in the middle column of the Event Properties dialog box, click **Primitive** to display a drop-down menu that lets you choose the type of primitive for which to substitute for RRDY (Normal) (see Figure 4.19 on page 262). Choose **ERROR**.
8. Click **OK** to close the Action Properties dialog box.
9. In the File menu, select **Save Scenario** to save the scenario.

In this example, you set the substitution action to happen at every occurrence of an RRDY (Normal) (as shown in the figure, the action is set for every occurrence). However, you can set an action to happen at other multiples of event occurrence (for example 5, 25, 1000 and so on). You also can set the action to happen at random, within a specified number of event occurrences.

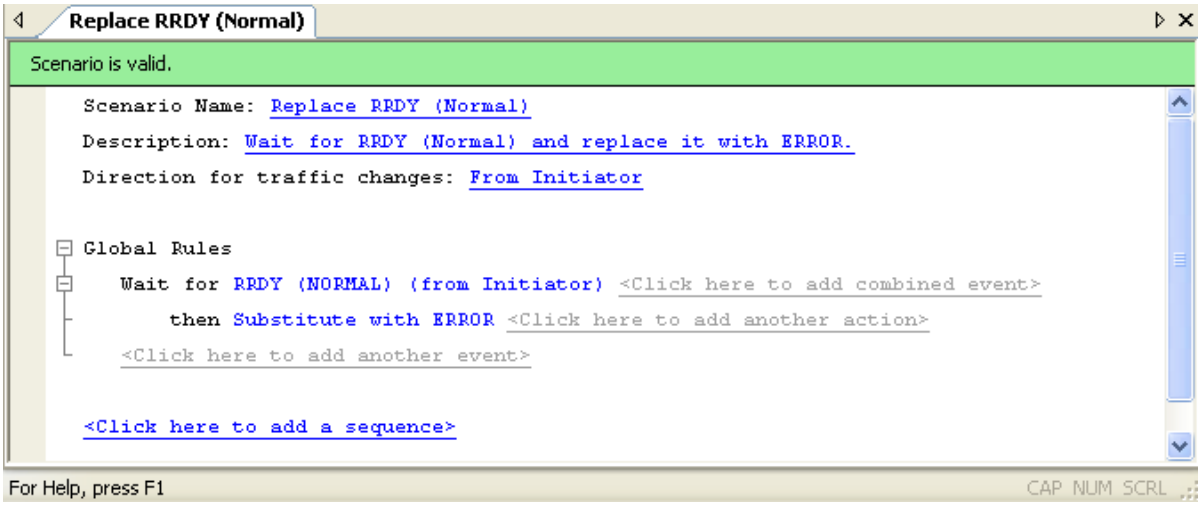


Figure 4.22: Example 2: Complete Scenario

Example 3: Creating OR Conditions

In this example, the Global Rules area of the scenario waits for either of two types of RRDY primitive and replaces them with an ERROR primitive.

This example includes a combined event (a logical OR association of two or more single events). Here, the combined event consists of any occurrence of RRDY (Normal) or RRDY (Reserved 0).

1. Click the **New Scenario** button in the main library or one of the device libraries. In the Scenario Properties dialog, enter the scenario name, description, and direction of traffic change.
2. In the Global Rules area, click the prompt to **add an event** to display the Event Properties dialog box.
3. As you did in example 1 of this chapter, choose **RRDY (Normal)** as the first primitive that you want to monitor.
4. Click the **add combined event** prompt to add a second event.

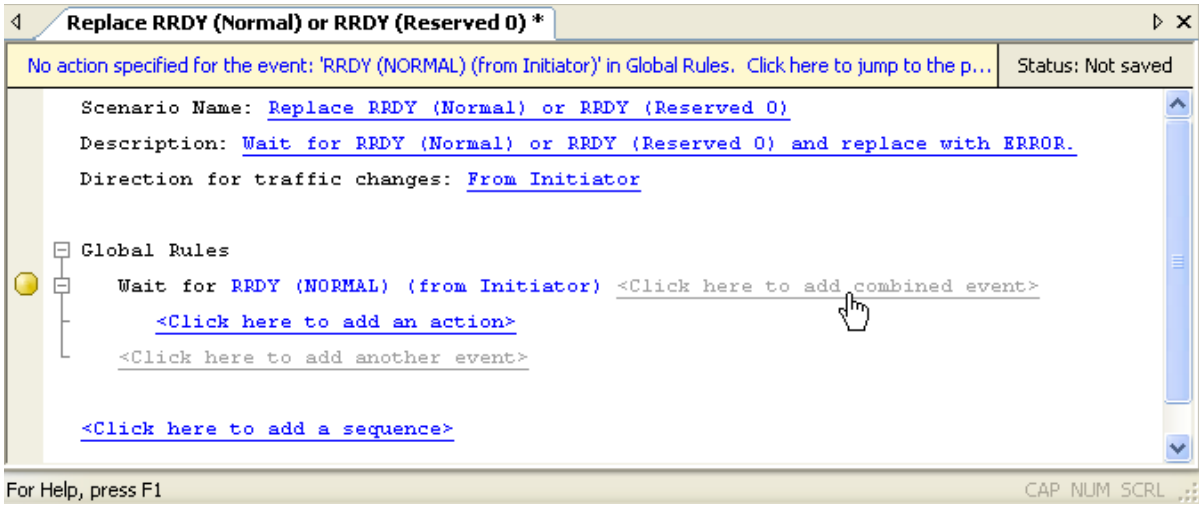


Figure 4.23: Example 3: Entering the Second Event

The Event Properties dialog box appears.

5. Choose **RRDY (Reserved 0)** as the second primitive that you want to monitor.
6. Click **OK** to close the Event Properties dialog box.
7. In the Global Rules area, click the prompt to **add an action** to display the Action Properties dialog box.
8. In the Type list on the left, choose **Substitute SAS Primitive** as the action that you want when either RRDY Reserved 0 or RRDY Normal occurs.
9. Click **OK** to close the Action Properties dialog box.

10. In the File menu, select **Save Scenario** to save the scenario.

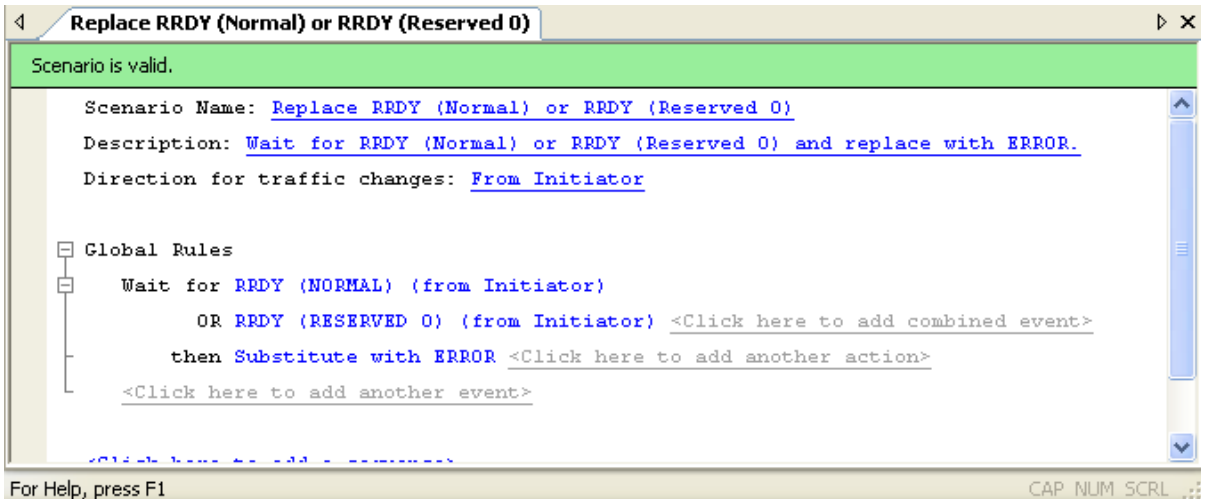


Figure 4.24: Example 3: Complete Scenario

Example 4: Multiple Triggers and Actions

In this example, the Global Rules area of the scenario waits for two events, each of which triggers a different action.

1. Click the **New Scenario** button in the main library or one of the device libraries. In the Scenario Properties dialog, enter the scenario name, description, and direction of traffic change.
2. As you did in example 2, choose **RRDY (Normal)** as the first event to monitor, and substitute with the SAS primitive **ERROR** as action.
3. In the Global Rules area, click the prompt to **add the next event** (keep in mind this is not a combined event).

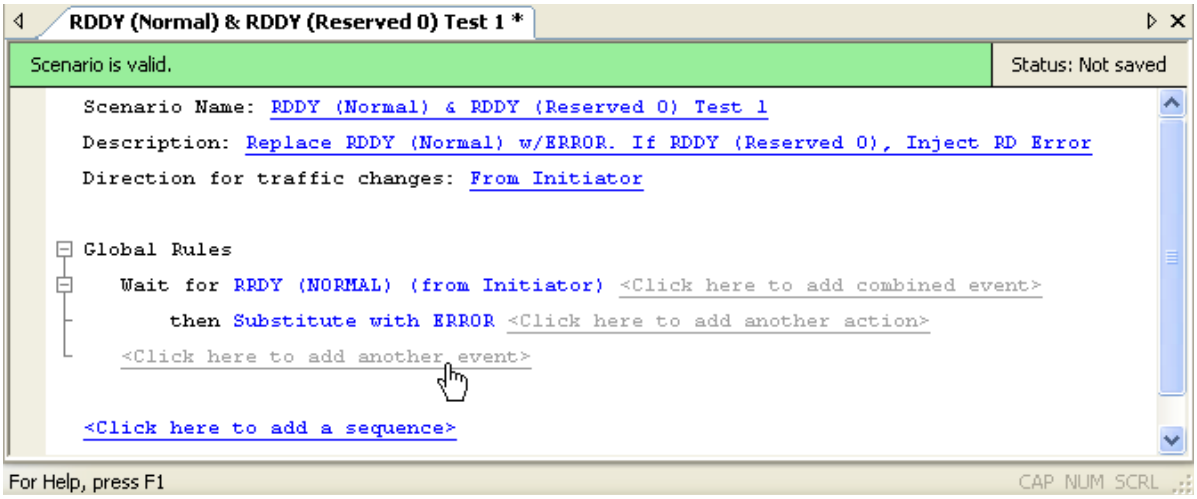


Figure 4.25: Example 4: Entering Second Event

The Event Properties dialog box appears.

In this example, there is a parallel set of events, but each event is associated with its own action. In a combined event, there is a parallel set of events sharing the same action.

4. Using the drop-down menu, choose **RRDY (Reserved 0)** as the second event to monitor.
5. Click **OK** to close the Event Properties dialog box.

6. In the Global Rules area, click the prompt to **add an action** to be triggered by the RRDY (Reserved 0).

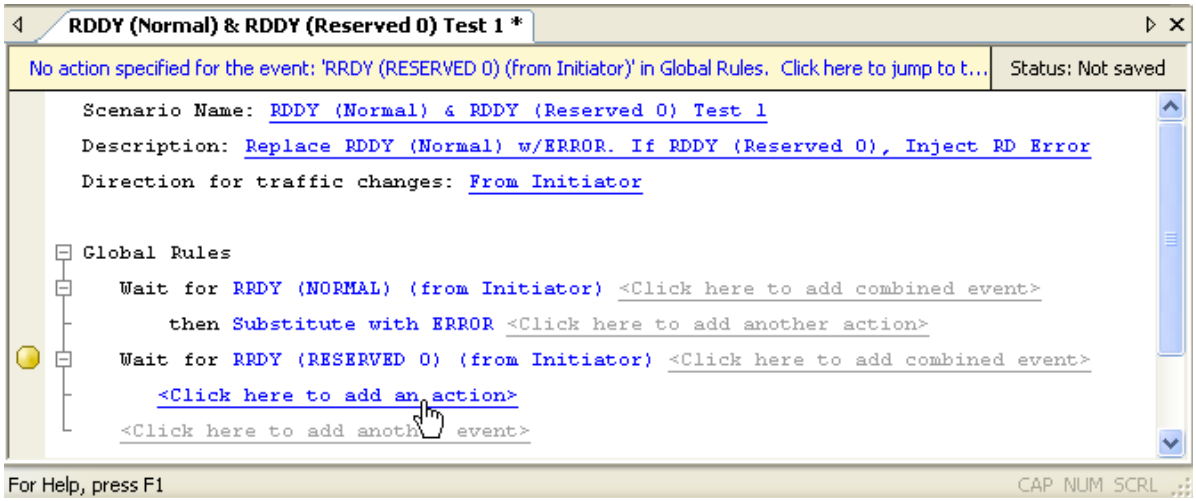


Figure 4.26: Example 4: Entering Second Action

The Action Properties dialog box appears.

7. Use it to choose **Inject RD Error** as the action triggered by RRDY (Reserved 0).
8. Click **OK** to close the Action Properties dialog box.

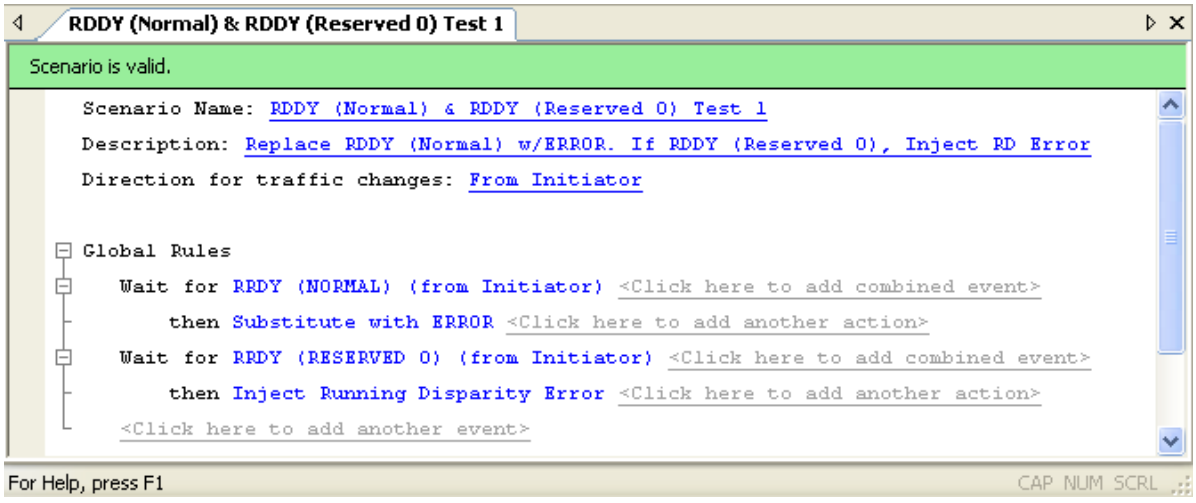


Figure 4.27: Example 4: Complete Scenario

9. In the File menu, select **Save Scenario** to save the scenario.

Example 5: Multiple Actions on a Single Event

In this example, an event triggers a set of actions. The actions occur at the same time. The device waits for an ACK from the initiator. When it occurs, the device beeps, injects an RD error, and increments a counter monitoring for that event (ACK from initiator).

1. Click the **New Scenario** button in the main library or one of the device libraries. In the Scenario Properties dialog, enter the scenario name, description, and direction of traffic change.
2. As in previous examples, configure the first event and its response in the Global Rules area. Choose **ACK** primitive as the event and **Beep** as the action. From the Action Properties drop-down menu, enter **500 ms** as the duration of the beep.
3. Click the **add another action** prompt to add a second action.

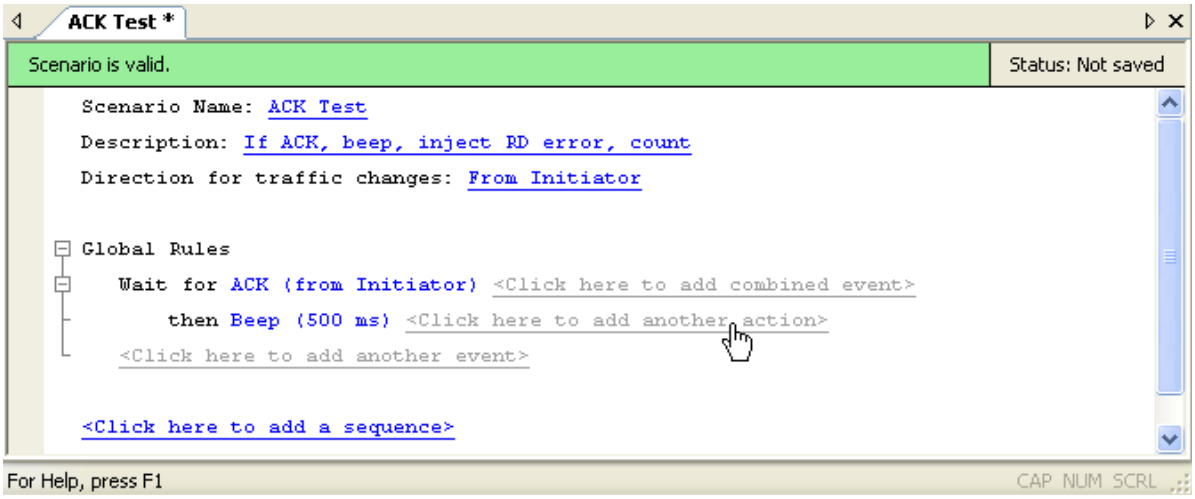


Figure 4.28: Example 5: Entering the Second Action

The Action Properties dialog box appears.

4. Choose **Inject RD Error** as the second action.
5. Click the **add another action** prompt to add a third action.
6. The Action Properties dialog box appears.
7. Choose **Monitor/Count** as the third action.

8. Click **OK** to close the Action Properties dialog box.

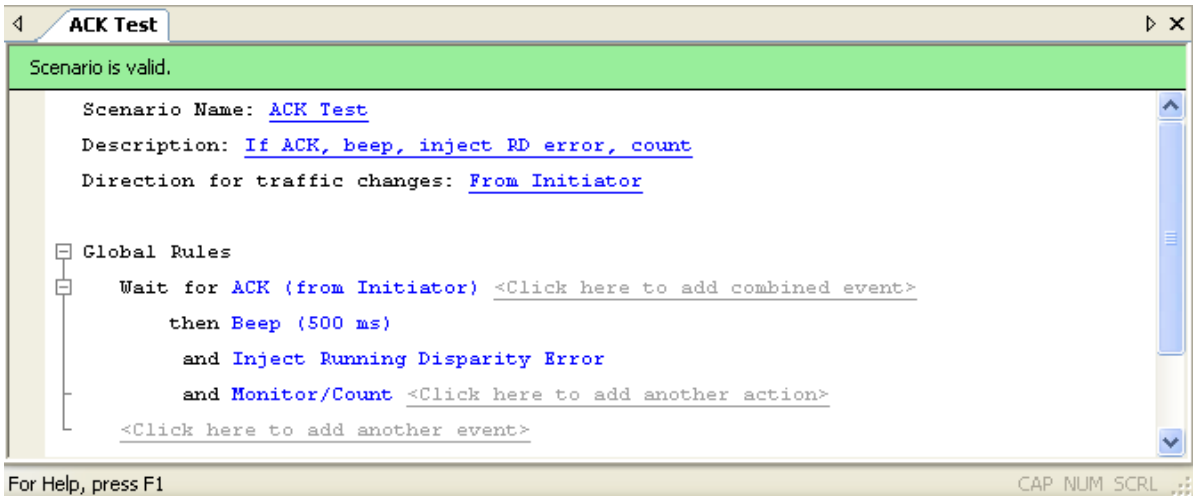


Figure 4.29: Example 5: Complete Scenario

9. In the File menu, select **Save Scenario** to save the scenario.

This example sets the counter to increment at each occurrence of an ACK (every 1 ACK).

Example 6: Using Timers

In this example, the Global Rules portion of the scenario waits for an ACK primitive from the initiator. Each time the device detects an ACK, it injects an RD Error into the traffic stream. This state continues for a random period of time, not to exceed 1.790 seconds. After the time period has elapsed (timer times out), the scenario stops.

Although this example sets the timer for a random period, you also can set the timer for known values (2 ms., 5 mins., 1 hr., and so on).

1. Click the **New Scenario** button in the main library or one of the device libraries. In the Scenario Properties dialog, enter the scenario name, description, and direction of traffic change.
2. As in previous examples, configure the first event and its response in the Global Rules area. Choose **ACK** primitive as the event and **Inject RD Error** as the action.
3. Click the prompt to **add another event** (keep in mind this is not a combined event).

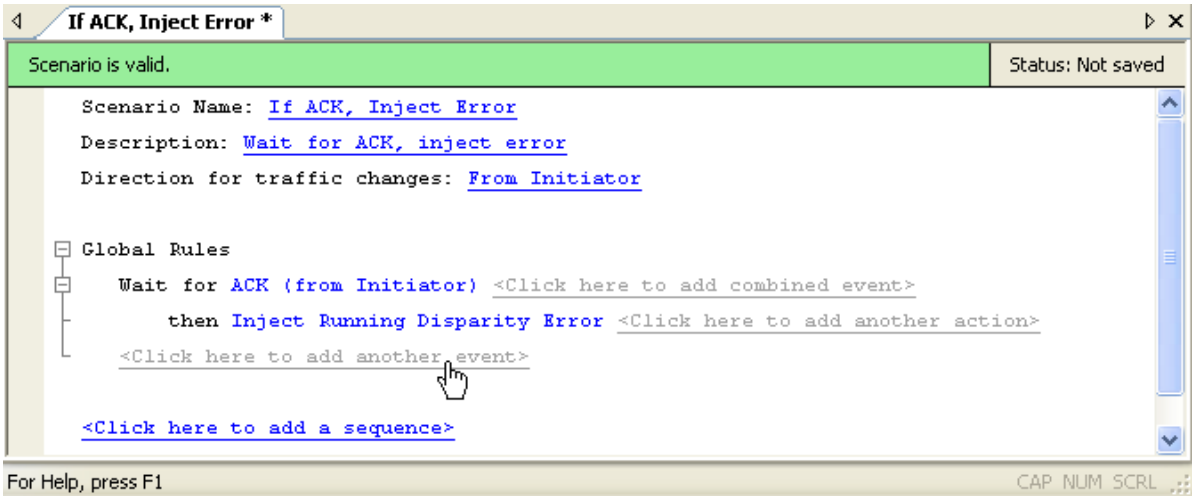


Figure 4.30: Example 6: Entering the Second Event

The Event Properties dialog box appears.

4. In the Type column on the left, choose **Timer**. Set the timer for random timing with a maximum time limit of 1.790 seconds.
5. Click **OK** to close the Event Properties dialog box.

6. Click the prompt to **add an action** to correspond with the second event.

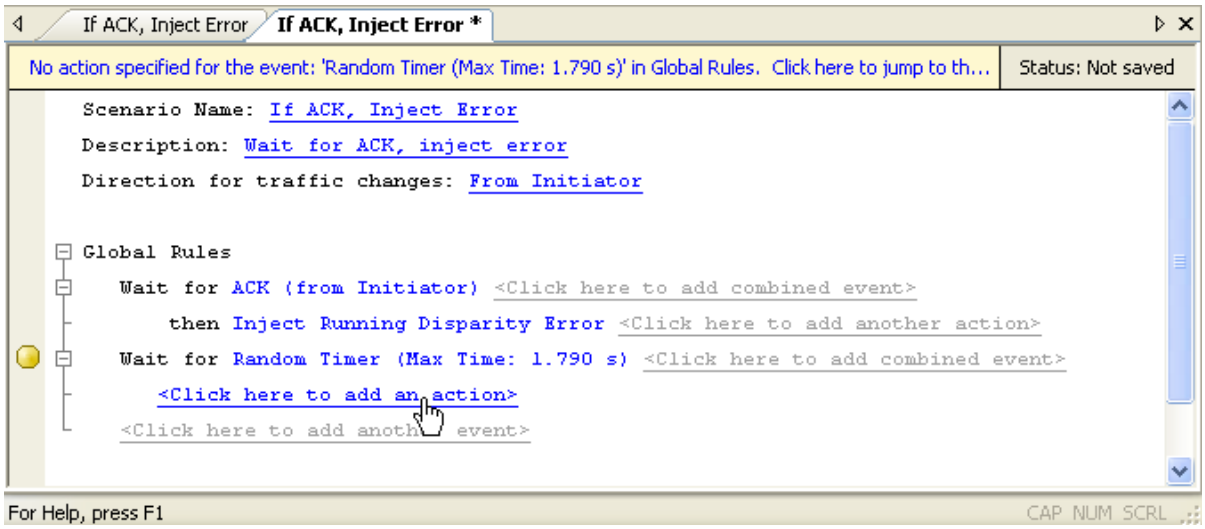


Figure 4.31: Example 6: Entering Second Action

The Action Properties dialog box appears.

7. In the Type list on the left, choose **Stop Scenario** as the action that you want after the timer has expired.
8. Click **OK** to close the Action Properties dialog box.

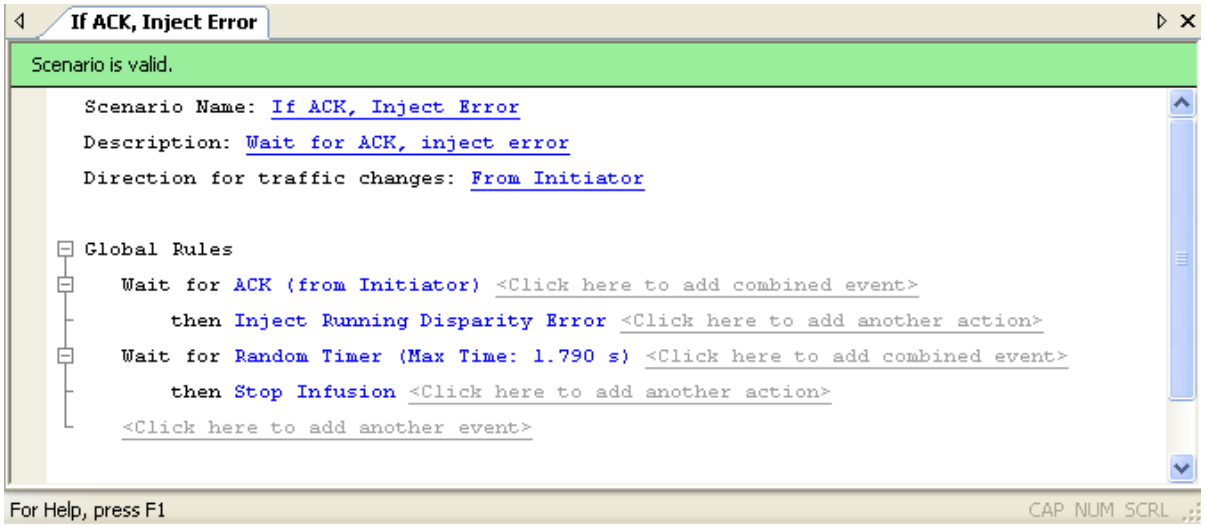


Figure 4.32: Example 6: Complete Scenario

9. In the File menu, select **Save Scenario** to save the scenario.

Creating a Sequence

This section gives several examples for creating sequences. Recall that a sequence can have multiple states, but only one state is active at any time. In other words, at any point in time, a sequence "waits" for one event (or combined event) and responds with the corresponding action or set of actions when the event occurs.

A sequence is more powerful than Global Rules, because you can create branching or looping test logic with a sequence.You can include up to two sequences in a scenario, but each is completely independent of the other. There is no branching or other interaction between the two, except through the Restart All Sequences action.

You must follow some simple rules when creating sequences:

TABLE 4.5: Sequence Rules

You can use only two branch actions per state. When you specify actions for a state, you can only use two instances of **Branch to an Existing State** or **Branch to a New State**. If you try to use more than two, a red error message appears in the status area of the application that says "Too Many Actions."
You can use only one restart sequence action per state. When you specify actions for a state, you can only use one instance of **Restart Current Sequence** or **Restart All Sequences**. If you try to use more than one, a red error message appears in the status area of the application that says "Too Many Actions."
You can use a maximum of 255 states per sequence. If you try to use more than 255 states, a red error message appears in the status area of the application.

The following table summarizes the examples that follow.

TABLE 4.6: Sequence Examples

Example	Description
7	**Creating two sequences and Global Rules**: This scenario has two objectives that you implement with Global Rules and two sequences. 1) You use Global Rules to replace any of three types of primitives. 2) You use two sequences to detect the order in which a type of frame is received from initiator and target.
8	**Creating a sequence with many states #1**: The objective of this scenario is to detect an incorrect order of primitives and to cause the device to beep when it happens. You implement this scenario with a single five-state sequence.
9	**Creating a sequence with many states #2**: This scenario is an enhancement of example 8. In this scenario, the objective is to detect an incorrect order of primitives, fix it, and cause the device to beep when this happens. As with example 8, you implement this scenario with a single five-state sequence.

Example 7: Creating Two Sequences and Global Rules

In this example, Global Rules substitute an Align (0) primitive for each of the following received from the initiator: Align (1), Align (2), and Align (3). As a separate test operation, two sequences determine the order in which each Identify Address frame is received from initiator and target.

The following tables summarize the logic implemented by each of the sequences.

TABLE 4.7: Example 7: Logic of Sequence 0

State	Description
State 0	If Address Frame is detected from initiator, go to State 1; otherwise, continue to check incoming frames (do not change state).
State 1	If next Address Frame detected is from target, beep 1 second.

TABLE 4.8: Example 7: Logic of Sequence 1

State	Description
State 0	If Address Frame is detected from target, go to State 1; otherwise, continue to check incoming frames (do not change state).
State 1	If next Address Frame detected is from initiator, beep 2 seconds.

There is no interaction between the two sequences. Each of them operates independently (and is independent of the Global Rules). However, the two sequences complement each other with their logic. In this sense, they both combine to implement a test objective.

1. Click the **New Scenario** button in the main library or one of the device libraries. In the Scenario Properties dialog, enter the scenario name, description, and direction of traffic change.
2. As in previous examples, create the Global Rules area.
3. Click the prompt to **add a sequence**. Prompts for the sequence appear beneath the Global Rules area. You create a sequence one state at a time. The application numbers states consecutively from 0 up (1, 2, 3, and so on).

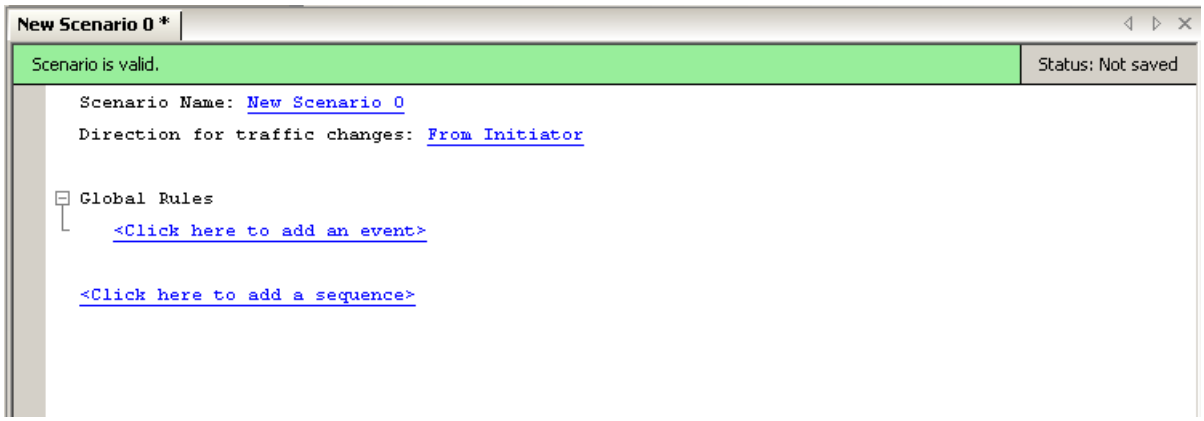


Figure 4.33: Example 7: Adding a Sequence

By default, the name of the first sequence in a scenario is Sequence 0. The name of the first state is State 0. To change the name of a sequence or state, or to associate a description with it, click the name of the sequence or state. A dialog box appears that allows you to enter that information.

Note: The description does not appear on screen, but you can bring it up by clicking the name of the sequence or state.

4. In the State 0 area, click the prompt to **add an event**.

Figure 4.34: Example 7: Adding an Event for the First State

The Event Properties dialog box appears.

5. In the Event Properties dialog box, select **Address Frame** as the event.
6. Click **OK** to close the Event Properties dialog box.
7. In the State 0 area, click the prompt to **add an action**.

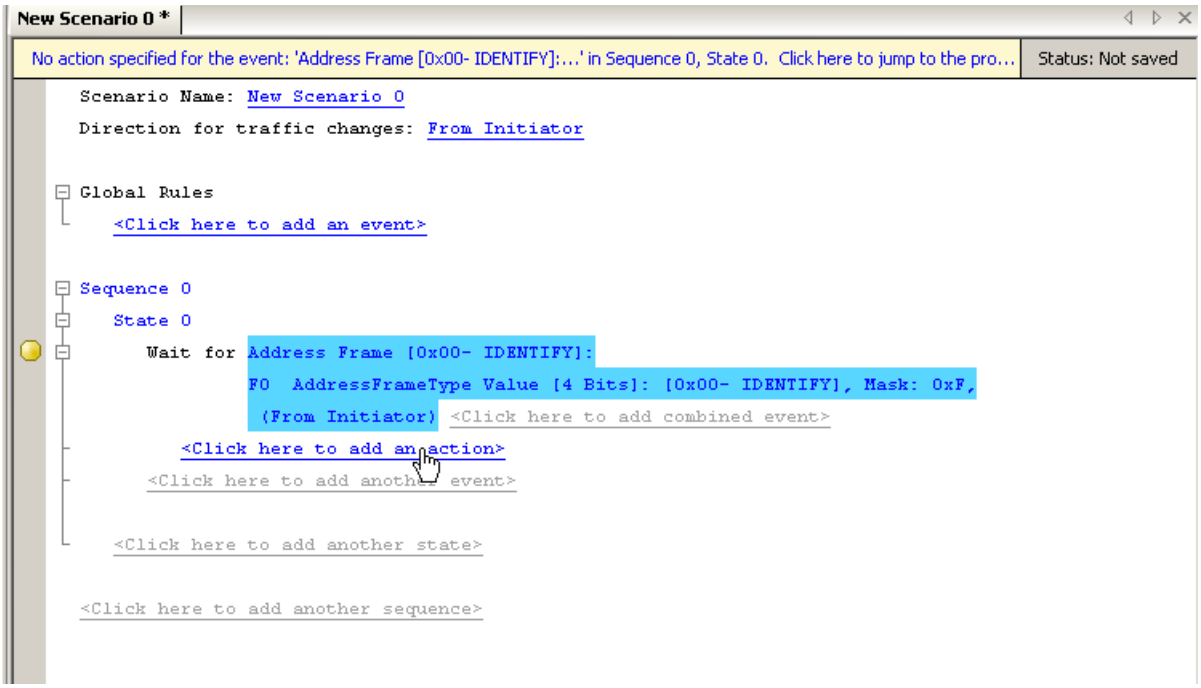


Figure 4.35: Example 7: Adding an Action for the First State

The Action Properties dialog box appears

8. For the action, select **Branch to > New State**.
9. Click the **OK** button to close the Action Properties dialog box.
10. This saves the action and automatically creates an area for State 1 in the scenario.
11. In the State 1 area, click the prompt to **add an event**. The Event Properties dialog box appears.
12. Choose the **Address Frame** event. In the Direction column, select **From Target** (you want State 1 to trigger on an Identify Address frame received from the target).
13. Click **OK** to close the Event Properties dialog box.

14. Click the prompt to **add an action** for State 1.

Figure 4.36: Example 7: Adding an Action to the Second State

The Action Properties dialog box appears.

15. In this example, you enter the action **Beep**, and you set the duration of the beep for 1 second.
16. Click **OK** to close the Action Properties dialog box.

17. You are finished creating the first sequence. Click the **add another sequence** prompt to create an area in the scenario for the second sequence (Sequence 1).

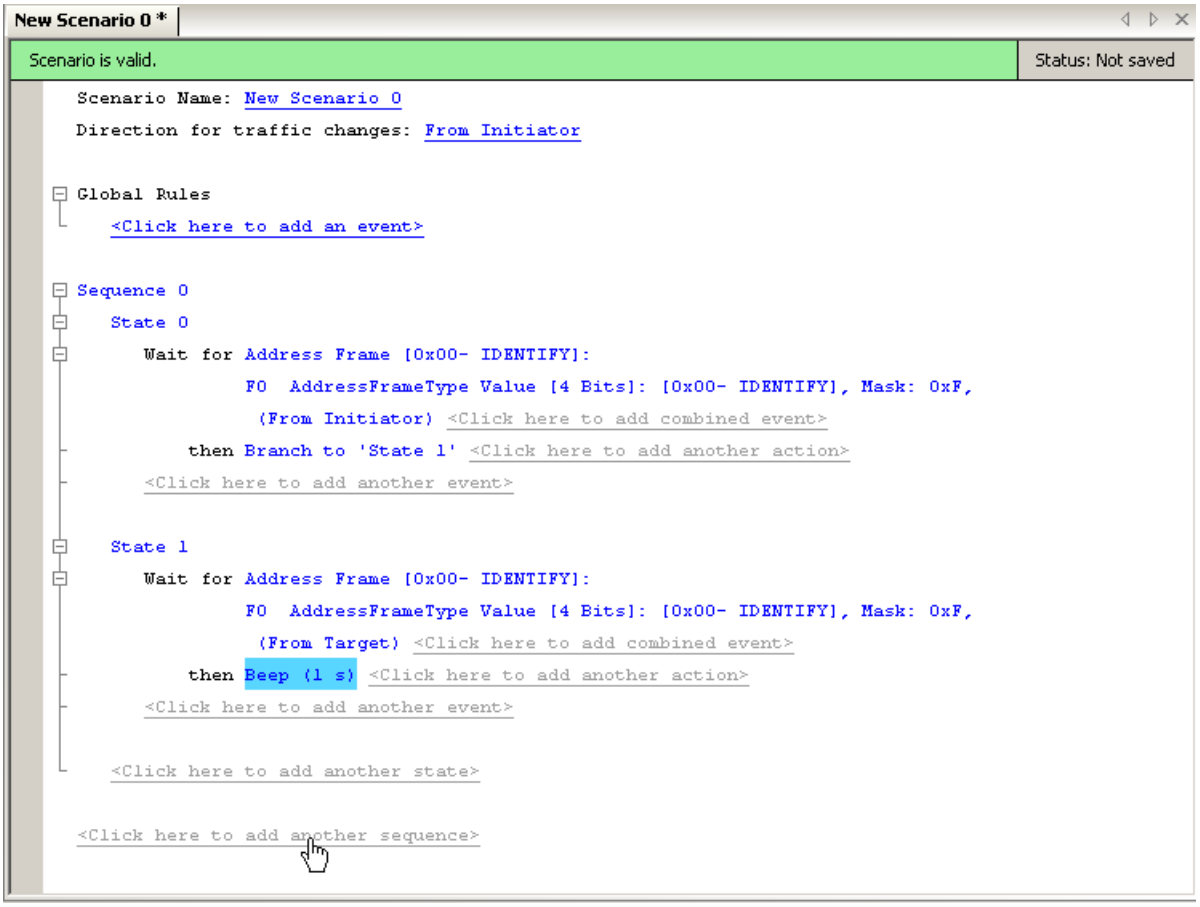


Figure 4.37: Example 7: Adding a Second Sequence

18. Create two states in the second sequence with the characteristics shown in the following table.

TABLE 4.9: Example 7: States for Second Sequence

State	Event	Action
0	Address Frame from Target	Branch to State 1
1	Address Frame from Initiator	Beep for 2 seconds.

19. In the File menu, select **Save Scenario** to save the scenario.

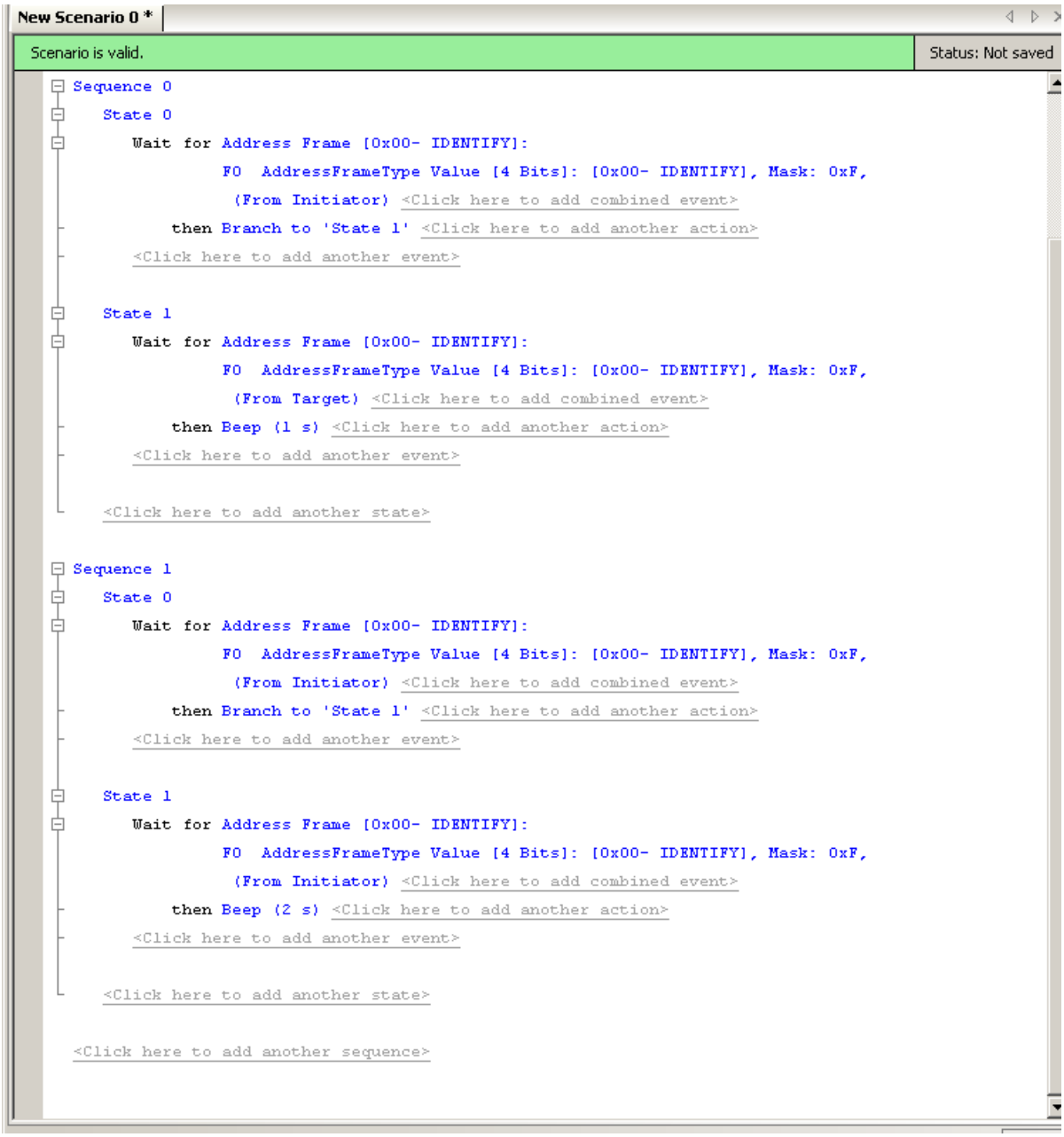


Figure 4.38: Example 7: Sequence Area of Scenario

Example 8: Creating a Sequence With Many States #1

In this example, a five-state sequence detects if a group of primitives is received out-of-order from the initiator. The expected order is: Align (0), Align (1), Align (2), Align (3). If this scenario detects any other order of these primitives, it causes the device to beep and the scenario to restart.

This example is designed to give you an idea of the powerful logic that you can implement with sequences.

Note: The states in this sequence have been renamed (do not have their default names). The following table summarizes the sequence logic.

TABLE 4.10: Example 8: Logic of Sequence 0

State	Description
Wait for Align (0)	When an Align (0) is received, go to Wait for Align (1).
Wait for Align (1)	If an Align (1) is received next, go to Wait for Align (2); otherwise, go to Indicate Error.
Wait for Align (2)	If an Align (2) is received next, go to Wait for Align (3); otherwise, go to Indicate Error.
Wait for Align (3)	If an Align (3) is received next, restart test; otherwise go to Indicate Error.
Indicate Error	Indicate error and restart test.

1. Click the **New Scenario** button in the main library or one of the device libraries. In the Scenario Properties dialog, enter the scenario name, description, and direction of traffic change.
2. As in previous examples, create the five states for this sequence.

3. In the File menu, select **Save Scenario** to save the scenario.

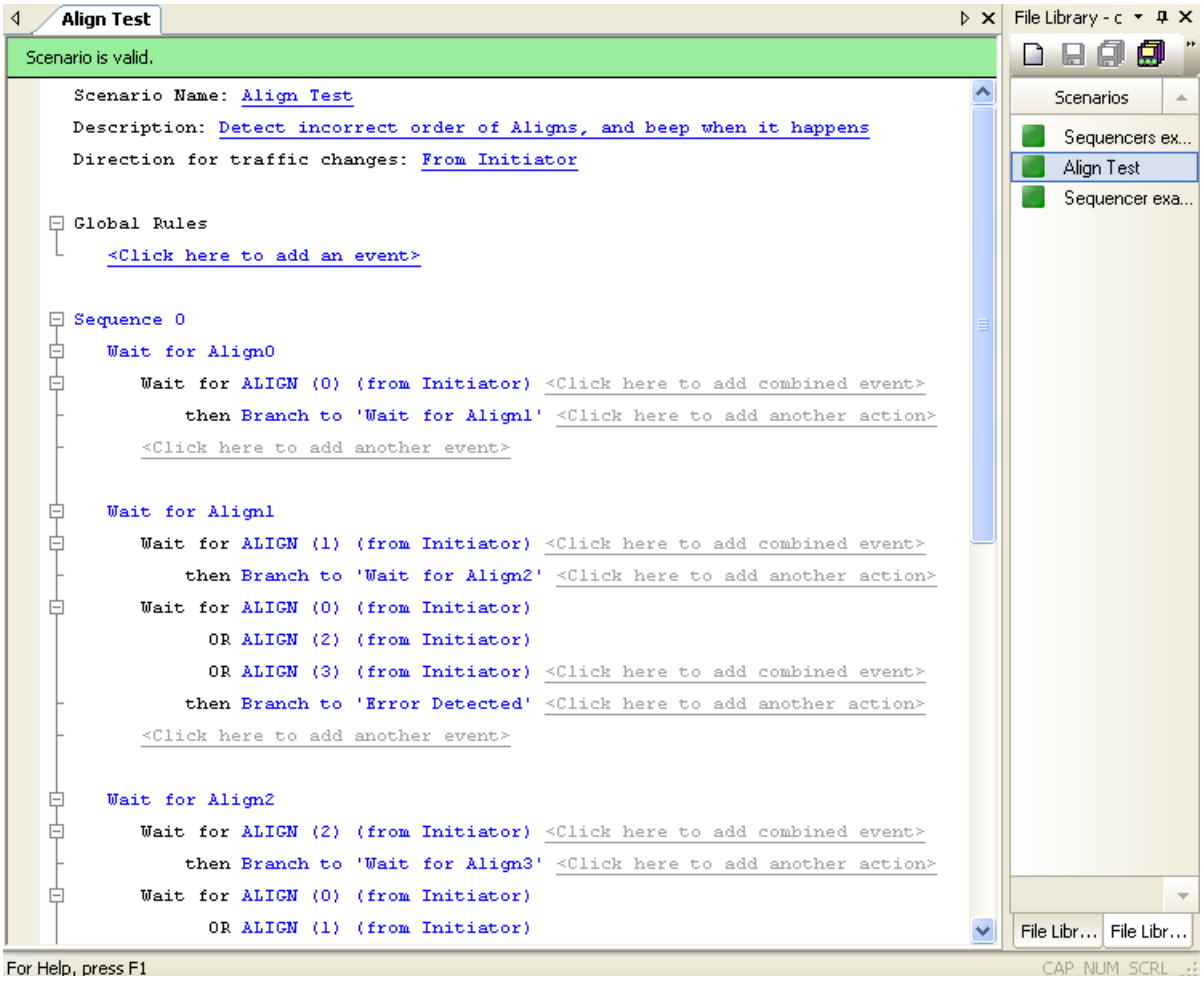


Figure 4.39: Example 8: Top Half of Scenario

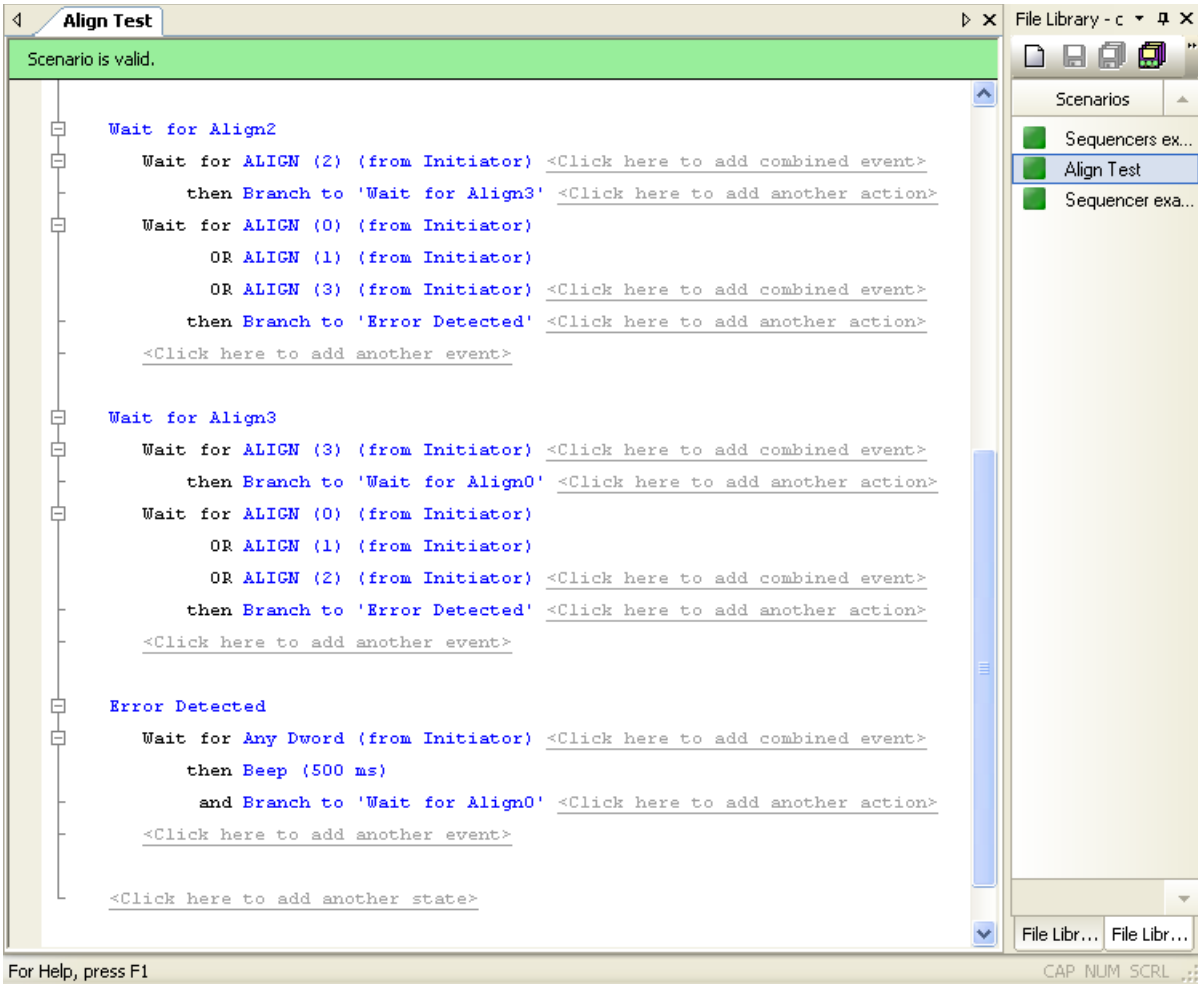


Figure 4.40: Example 8: Bottom Half of Scenario

Example 9: Creating a Sequence With Many States #2

In this example, a five-state sequence not only detects if a group of primitives is received out-of-order, but it fixes any incorrect order. The logic is similar to that of example 8 with a few small changes. The following table summarizes each state.

TABLE 4.11: Example 9: Logic of Sequence 0

State	Description
Wait for Align (0)	When an Align (0) is received, go to Wait for Align (1).
Wait for Align (1)	If an Align (1) is received next, go to Wait for Align (2); otherwise, replace primitive with Align (1) and go to Indicate Error.
Wait for Align (2)	If an Align (2) is received next, go to Wait for Align (3); otherwise, replace primitive with Align (2) and go to Indicate Error.
Wait for Align (3)	If an Align (3) is received next, restart test; otherwise, replace primitive with Align (3) and go to Indicate Error.
Indicate Error	Indicate error and restart test.

1. Click the **New Scenario** button in the main library or one of the device libraries. In the Scenario Properties dialog, enter the scenario name, description, and direction of traffic change.
2. As in previous examples, create the five states for this sequence.

3. In the File menu, select **Save Scenario** to save the scenario.

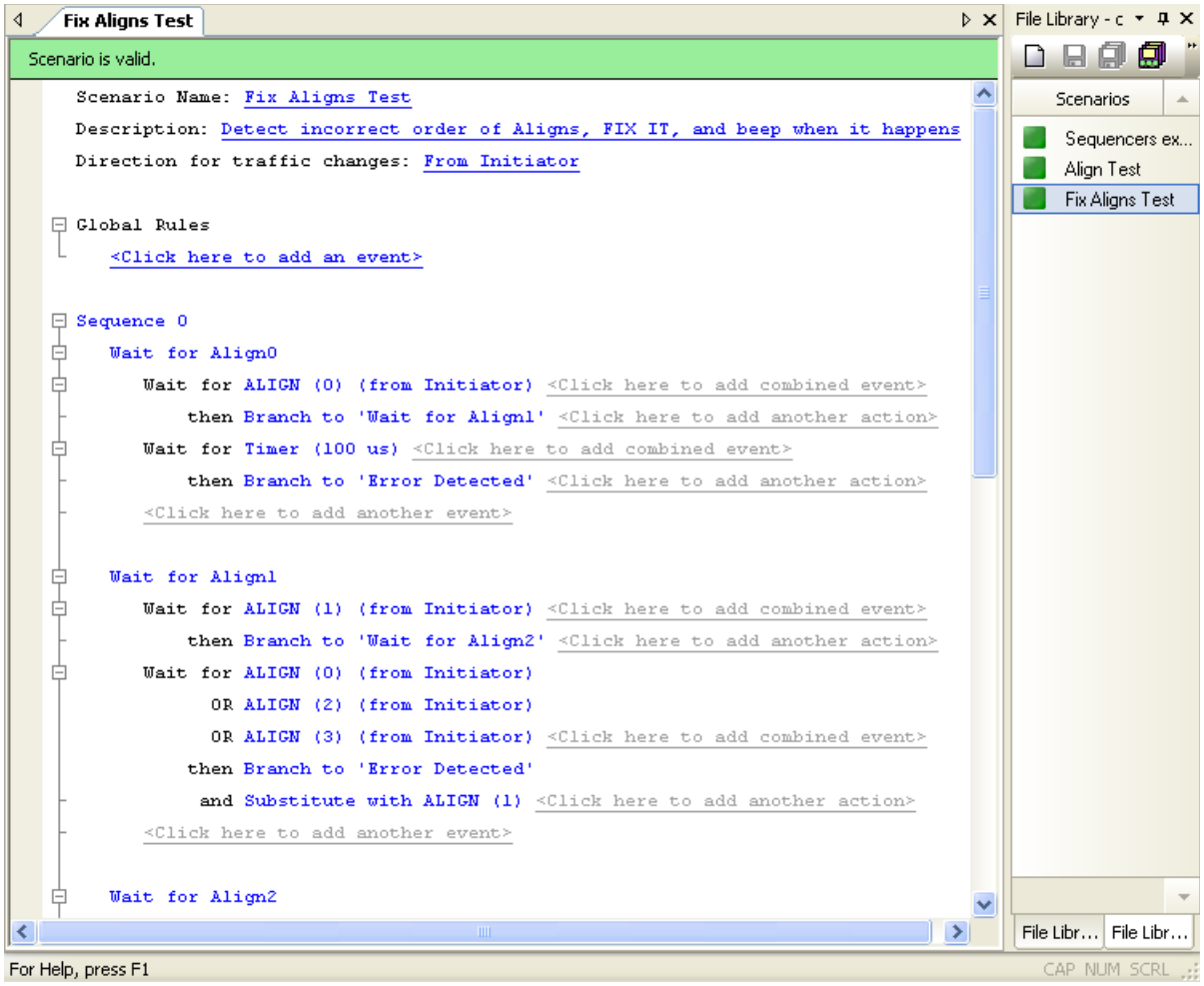


Figure 4.41: Example 9: Top Half of Scenario

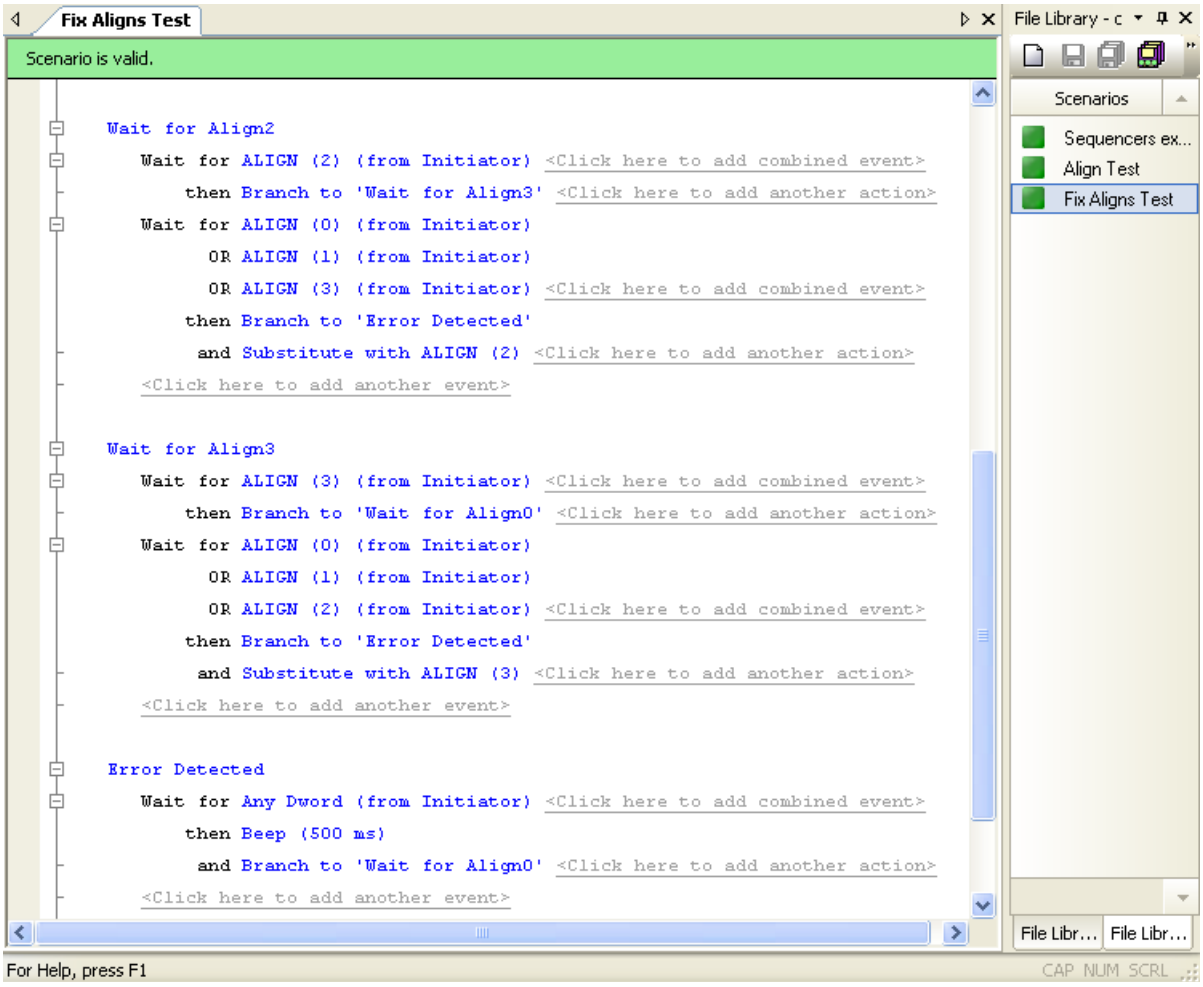


Figure 4.42: Example 9: Bottom Half of Scenario

Downloading Scenarios

After you have created a scenario, you need to download it to the InFusion device for execution.

If you use a general library as a scenario archive, then the process of creating and downloading a scenario is as follows:

1. Open the general library (Main library or a File library). Scenarios in the library are listed in the Main Library window.
2. Open the Device Library window by clicking the **Show Device Library** button on application toolbar.
3. Open the Device Library for the device to which you want to download a scenario or scenarios. You can open the device library in two ways: by clicking the **Device Library icon** in the device list window or by double-clicking the **device name**.
4. Copy the scenario from general library to device library by dragging it with the mouse.
5. Download all scenarios in the device library to the InFusion device. To do so, click the **Download all Scenarios** button on the Device Library toolbar (second button from left).

Running Scenarios

If you use a general library as a scenario archive, then the process of executing a scenario is as follows:

1. Select the scenario to run by clicking it.
2. To run the scenario, click the **Run Scenario** button on the Device Library toolbar (second button from the right). The InFusion device then begins its session.

Scenario Batch Files

You can write a script with commands to run a sequence of executable scenarios automatically. A Scenario Batch file is a text file with a list of commands to run in sequence when you execute the file. A batch script can manage scenarios and their assigned ports and hardware in sequence, using conditions. The system checks for accuracy of inputs and commands.

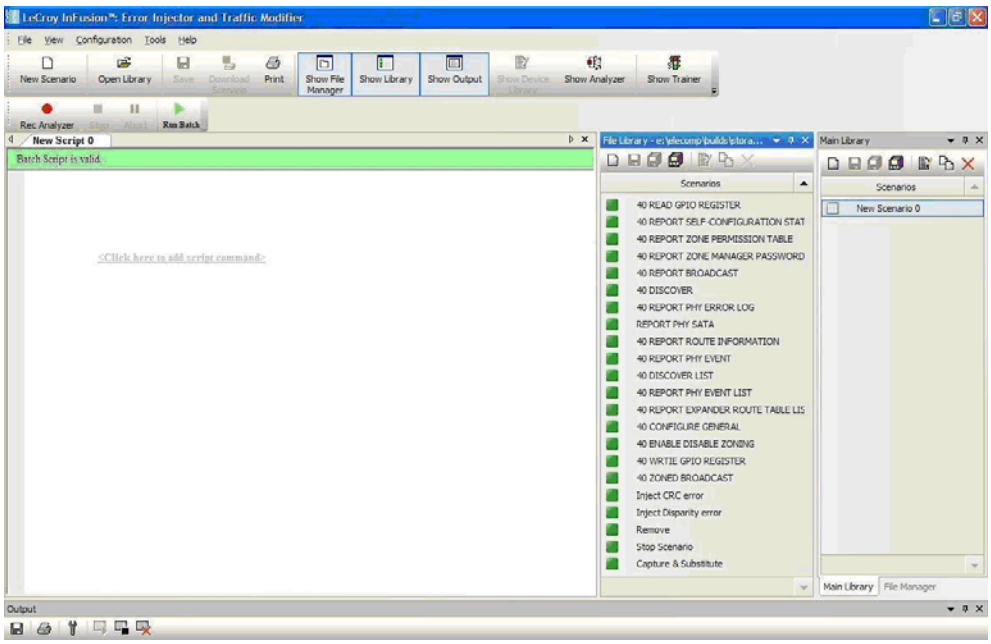
Note: Before you run a Scenario Batch file that requests scenarios, you must download the scenarios to the Scenarios box.

To start a batch script, click the **New Batch Script**

button or select **File > New Batch Script**.

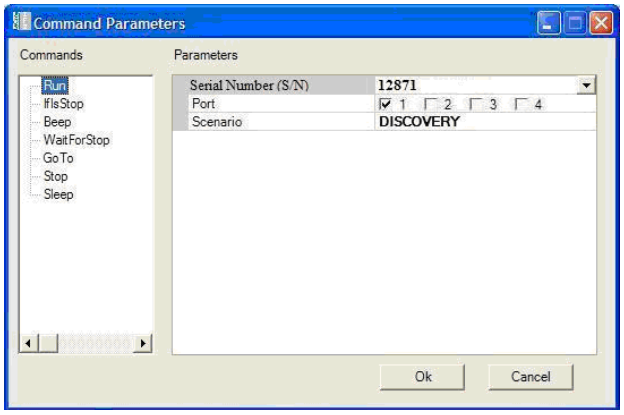
Script Workspace

In the Script Workspace, add a command and make a batch file.



In this window, you can enter a script command by clicking **Click here to add script command**.

3. First, click **Click here to add script command** to open the Command Properties dialog.



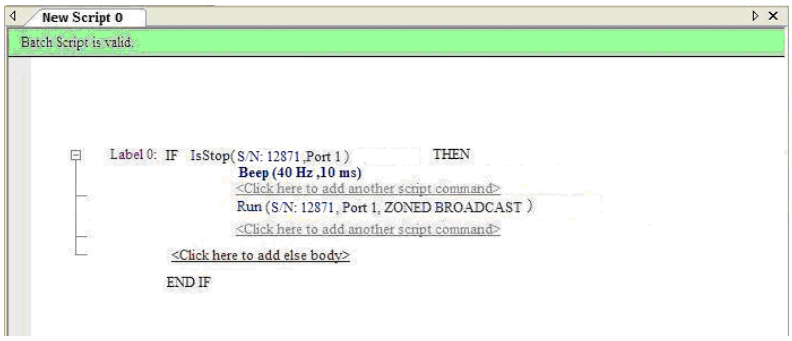
The Command Parameters Dialog contains the list of available commands and their parameters from which to build scenarios and connected hardware and available ports.

4. Select appropriate parameters for the command and click **OK** to display the script in the Script Workspace.

Note: You can select ports from the port list, depending on number of ports licensed.

Note: The hardware Serial Number can already exist or not. If the Serial Number exists, the Serial Number (for example, S/N: 12871) is shown. In Offline and Simulation mode, you can enter a Serial Number. In Online mode, you can only enter an existing Serial Number.

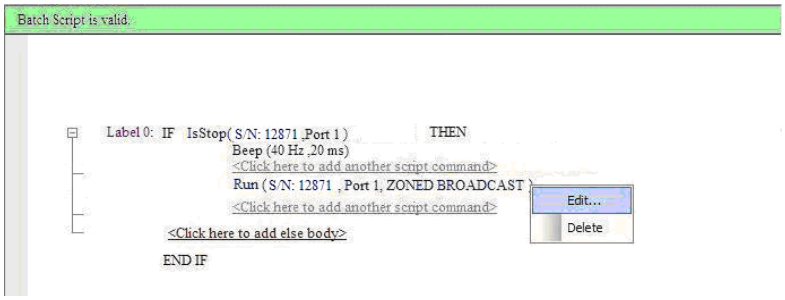
5. To add another command, click **Click here to add another script command**.



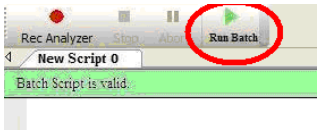
To copy a script command, right-click on the command and select **Copy**. Right-click **Click here to add another script command** and then select **Paste**.

You can also cut, delete, and edit a selected script command.

6. To edit batch commands, click the command, or right-click the command and select **Edit** from popup menu.



7. **To delete a command**, right-click and select **Delete** from popup menu, or select command and press **Delete** key on keyboard.
8. After finishing, if everything is correct, push the **Run Batch** button to execute scenario and save result in the log file.

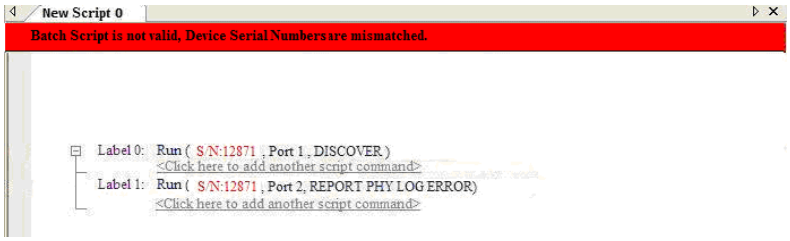


Note: Before you run a Scenario Batch file that requests scenarios, you must download the scenarios to the Scenarios box.

Error Checking

The Script Workspace shows errors by red color. The program reports all errors in the log file.

If you use a script from other InFusion hardware, it may cause an error, for example, mismatch in hardware Mac addresses, or scenarios that are not already in current hardware.



Log

Results of executable batch commands are saved automatically into a log file with user-specified name. The status of executable commands is shown in log area.

Statements

Statements can be conditional statements or non-conditional statements.

IfIsStopped

Shows whether a scenario is already stopped or not.

Format

```
IfIsStopped (Serial Number, Target Port)
```

Parameters

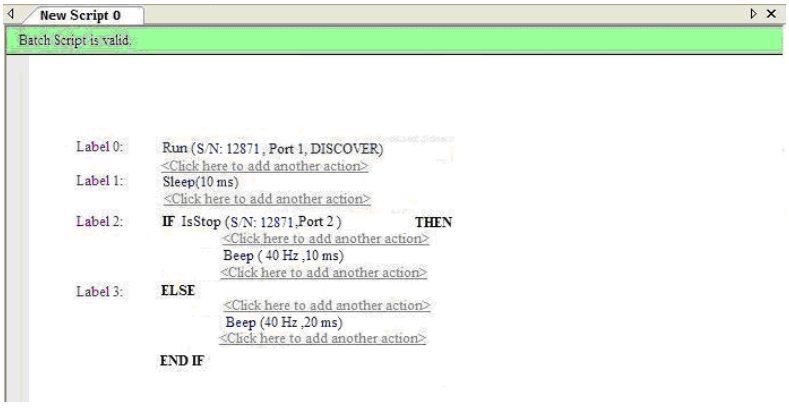
- **Serial Number**: Serial number of hardware
- **Target Port**: Port number in port map

Example

```
IfIsStopped(ox01267, 1) Then
  {
  Beep (750, 300)
  Run (ox01267," Detect AddressFrame Open", 5)
  }
```

The value of second parameter is 5 and shows check stopping mode of combination of port number 1 and port number 3.

After filling parameters from the Command Parameters Dialog, the program makes the IF-ELSE structure in the Script workspace. The ELSE statement is optional. To add an ELSE body, click **Click here to add else body**.



Goto Label

Goes to specified label. Labels can be assigned to each script line.

Format

```
Goto Label3
```

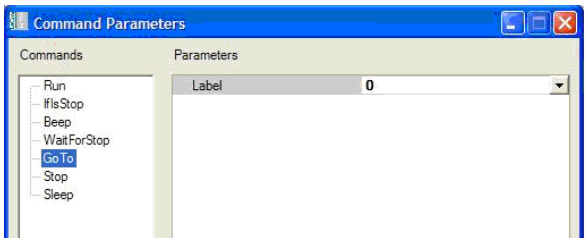
Parameters

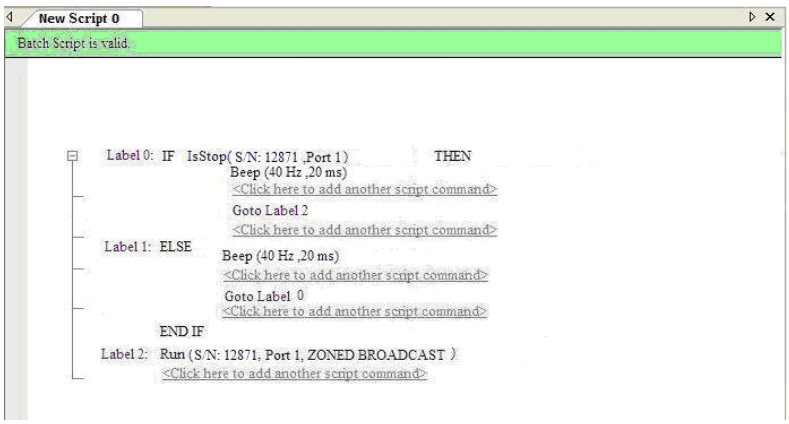
None

Example

```
Label3: WaitForStop(0x83456, 2, 100))
Run (ox01267," Inject CRC000", 4)
Goto Label7
```

Note: You can use a **Label** and a **Goto Label** to make loops. First make the label, then make Goto Label. The Command Parameters window shows only enabled Labels. Labels are disabled by default and are in gray color. To enable them, click them to make purple color.





Run

Runs the scenario on hardware on specified ports. If you call this command for the first time and the scenario was not assigned to the hardware and ports before, the scenario is assigned to specified hardware and ports and then scenario runs on the hardware.

Format

```
Run(Serial Number, Scenario Name, Target Port)
```

Parameters

- **Serial Number**: Serial number of hardware
- **Scenario Name**: Name of scenario
- **Target Port**: Port number in port map

Example

```
Run (ox841200," Substitute address frame", 4)
Beep(800, 400)
Run (ox841200," CRC Inject _ Play CD", 8)
WaitForStop(0x63463, 1, 150)
Run (ox841200," Remove Send Cue Sheet", 2)
Goto Label6
Run (S/N: 12871, Port 1, DISCOVER)
```

Note: If the selected ports are busy, scenario cannot run, and the command will be skipped. The result will be written in Log area.

Stop

Stops running scenario by hardware and port name.

Format

```
Stop (Serial Number, Target Port)
```

Parameters

- **Serial Number**: Serial number of hardware
- **Target Port**: Port number in port map

Example

```
Run (ox00820,"Inject CRC000", 2)
Beep(700, 500)
Stop (ox00820, 2)
Goto Label3
...
Label3 : Run(ox005007,"Detect DATA", 8)
Sleep(40)
```

WaitForStop

Used to wait for occurrence of specified condition.

Format

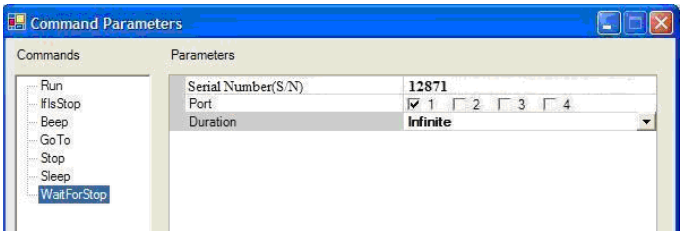
```
WaitForStop(SerialNumber, Target Port, Duration)
```

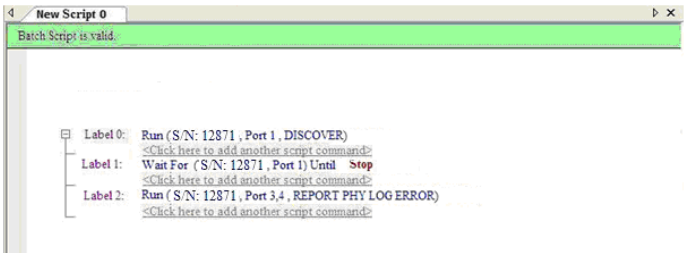
Parameters

- **Serial Number**: Serial number of hardware
- **Target Port**: Port number in port map
- **Duration**: Integer or random duration in milliseconds. In the Command Parameters Window, WaitForStop duration has three options:
  - **Infinite**: Wait until **Stop** command.
  - **Random**: Stop after a random time.
  - **Finite time**: Stop after specified time in milliseconds.

Example

```
Run (ox001267,"Detect AddressFrame Open", 2)
WaitForStop (0x348790, 2, Forever)
Run (ox005007,"Detect DATA", 4)
WaitForStop(ox005007, 4, 100)
Stop (ox001267, 2)
```





Sleep

Used to sleep for a few seconds.

Format

```
Sleep(Duration)
```

Parameters

- **Duration**: Integer or random duration in milliseconds

Example

```
Sleep(100)
```

Beep

If specified condition is satisfied, the system beep for specified duration.

Format

```
Beep (Duration, Frequency)
```

Parameters

- **Duration**: Integer or random duration in milliseconds
- **Frequency**: Frequency in hertz

Example

```
IfIsStopped(0x83456, 4)) then
  {
  Beep (2, 20)
  Run (0x83456,"Identify_Disparity error", 8)
  }
```

Appendix A

Creating a Pattern Generator File

You may use any text editor or word processor to create a pattern generator file (*.spg) using the following conventions:

Key words

ALIGN
CONT
DMAT
EOF
HOLD
HOLDA
PMACK
PMNAK
PMREQ_P
PMREQ_S
R_ERR
R_IP
R_OK
R_RDY
SOF
SYNC
WTRM
X_RDY
XXXX
LOOP
Enable
Disable
Host
Device
Scramble
Role
END_OF_FILE

Comment format

```
/*Comment text*/
```

Primitive definition format

To add an ALIGN primitive, use ALIGN or 27.3 10.2 10.2 K28.5

To add a CONT primitive, use CONT or 25.4 25.4 10.5 K28.3

Loop definition format

You may write a defined pattern into memory repeatedly by enabling a loop.

Loop definition allows either “Enable” or Disable”. To enable looping use: Loop=Enable

Scramble definition format

Scramble definition allows either “Enable” or Disable”. To enable scramble use: Scramble=Enable

Role definition format

To specify SATA hardware role: Role=Host or Role=Device

END_OF_FILE definition

A pattern generator file must include END_OF_FILE as the last statement in the file.

Example Pattern Generator File

Figure A-1 illustrates a typical Pattern Generator file.

```
/*……Set Device Bits……*/
/*Device*/
23.2 23.2.21.5 K28.3                /*X_RDY*/
23.2 23.2.21.5 K28.3                /*X_RDY*/
25.4 25.4.10.5 K28.3                /*CONT*/
XXXX
XXXX
XXXX
XXXX
XXXX
XXXX
XXXX
23.1 23.1 21.5 K28.3                /*SOF*/
00 50 40 A1
E0 00 00 00
21.6 21.6 21.5 K28.3                /*EOF*/
24.2 24.2 21.5 K28.3                /*WTRM*/
24.2 24.2 21.5 K28.3                /*WTRM*/
25.4 25.4 10.5 K28.3                /*CONT*/
XXXX
XXXX
XXXX
XXXX
21.5 21.5 21.4 K28.3                /*SYNC*/
21.5 21.5 21.4 K28.3                /*SYNC*/
25.4 25.4 10.5 K28.3                /*CONT*/
XXXX
XXXX
XXXX
XXXX
Role=Device
Loop=Enable
Scramble=Disable
END_OF_FILE
/*……..*/
```

Figure A.1: Sample Pattern Generator File *spg

Appendix B

China Restriction of Hazardous Substances Table

The following tables are supplied in compliance with China's Restriction of Hazardous Substances (China RoHS) requirements:

	有毒有害物质和元素					
部件名称	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr^{6+})	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
PCBAs	X	O	X	X	X	X
机械硬件	O	O	X	O	O	O
金属片	O	O	X	O	O	O
塑料部件	O	O	O	O	X	X
电源	X	X	X	O	X	X
电源线	X	O	X	O	X	X
保护外壳(如有)	O	O	O	O	X	X
电缆组件(如有)	X	O	X	O	X	X
风扇(如有)	X	O	X	O	X	X
交流滤波器和熔丝组件(如有)	X	O	X	O	O	O
外部电源(如有)	X	X	X	O	X	X
探头(如有)	X	O	X	O	X	X
O: 表明该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T11363-2006 标准规定的限量要求之下。						
X: 表明该有毒有害物质至少在该部件的某一均质材料中的含量超过 SJ/T11363-2006 标准规定的限量要求。						

EFUP (对环境友好的使用时间) 使用条件:
温度: 5摄氏度到40摄氏度
湿度: 5% - 95%最大相对湿度 (无冷凝)
高度: 最高2000米

	Toxic or Hazardous Substances and Elements					
Part Name	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (Cr^{6+})	Polybrominated Biphenyls (PBB)	Polybrominated Diphenyl Ethers (PBDE)
PCBAs	X	O	X	X	X	X
Mechanical Hardware	O	O	X	O	O	O
Sheet Metal	O	O	X	O	O	O
Plastic Parts	O	O	O	O	X	X
Power Supply	X	X	X	O	X	X
Power Cord	X	O	X	O	X	X
Protective Case (if present)	O	O	O	O	X	X
Cable Assemblies (if present)	X	O	X	O	X	X
Fans (if present)	X	O	X	O	X	X
AC Filter/Fuse Assy (if present)	X	O	X	O	O	O
Ext Power Supply (if present)	X	X	X	O	X	X
Probes (if present)	X	O	X	O	X	X
O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement specified in SJ/T11363-2006.						
X: Indicates that this toxic or hazardous substance contained in at least one of the homogenous materials used for this part is above the limit requirement specified in SJ/T11363-2006.						

EFUP (Environmental Friendly Use Period) Use Conditions:

Temperature	5C to 40C
Humidity	5% to 95% max RH (non-condensing)
Altitude	Up to 2000 meters

WAN Operation

WAN connected operation is supported. Contact factory for details of operation. Refer “How to Contact LeCroy” on page 303 for contact information.

Appendix C

How to Contact LeCroy

Type of Service		Contact
Call for technical support	US and Canada:	1 (800) 909-7112
	Worldwide:	1 (408) 653-1260
Fax your questions	Worldwide:	1 (408) 727-6622
Write a letter		LeCroy Protocol Solutions Group Customer Support 3385 Scott Blvd. Santa Clara, CA 95054-3115 USA
Send e-mail		psgsupport@lecroy.com
Visit LeCroy's web site		http://www.lecroy.com/

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